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BUREAU OF SHIPS GROUP

TECHNICAL INSPECTION REPORT

Classification (C[redacted]d) (Changed to CONFIDENTIAL (Action 15 Apr 49)
By Authority of Joint Chiefs of Staff
By [redacted] Date 1 May 51
AFSWP

U.S.S. SALT LAKE CITY (CA 25)

TEST BAKER

OPERATION CROSSROADS

DIRECTOR OF SHIP MATERIAL

JOINT TASK FORCE ONE

CONFIDENTIAL

[redacted]

BUREAU OF SHIPS GROUP

TECHNICAL INSPECTION REPORT

Classification (~~Confidential~~) (Changed to CONFIDENTIAL)
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[redacted] Capt. USN Date 1 May 51
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Director
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Washington, D. C. 20301

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APPROVED:
CONFIDENTIAL
F.X. Forest,
Captain, U.S.N.

[redacted]

USS SALT LAKE CITY (CA25)

Page 1 of 136 Pages

GROUP-3 : 1 JAN 1955
Downgraded at 12 year intervals;
Not automatically declassified.

[redacted] 1946.

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U.S.S. SALT LAKE CITY (CA 25)

SHIP CHARACTERISTICS

Building Yard: New York Shipbuilding Corporation.

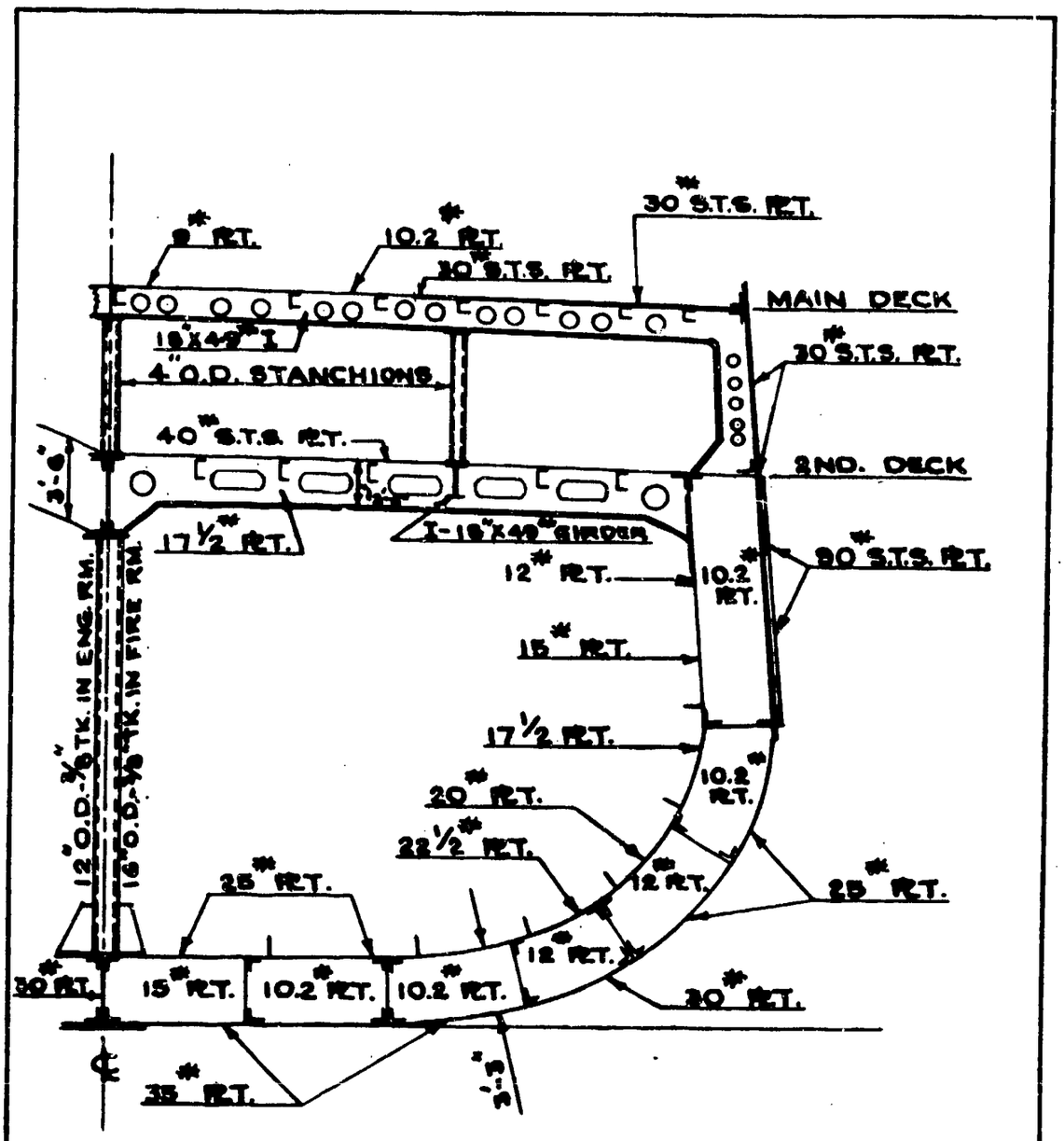
Commissioned: 11 December 1929.

HULL

Length Overall: 585 feet 8 inches.
Length on Waterline: 570 feet 0 inches.
Beam (extreme): 65 feet 3 inches.
Depth (molded at side, to main deck, amidships); 34 feet 1/4 inch.
Drafts at time of test: Fwd. 19 feet 2 inches.
Aft. 20 feet 9 inches.
Standard displacement: 9,100 tons.
Displacement at time of test: 11,850 tons.

MAIN PROPULSION PLANT

Main Engines: Four sets of H.P. and L.P. turbines, one set per shaft. Type: Parson Turbines. Mfg. by New York Shipbuilding Corp.
Reduction Gears: Four sets, single reduction. Mfg. by De-Laval.
Main Condensers: Four installed in ship.
Boilers: Eight installed in ship. Type: White-Foster. Steam press. 300 psi gauge, temp. 422° F.
Propellers: Four installed.
Main Shafts: Four installed.
Turbo Generators: Four installed in ship. 250 K.W.



TYPICAL MIDSHIP SECTION

TEST B

TECHNICAL INSPECTION REPORT

OVERALL SUMMARY

I. Target Condition After Test.

(a) Drafts after test; list; general areas of flooding, sources.

	HULL Forward	Aft	List
Before Test B Drafts	19' 3"	20' 6"	0°
After Test B Drafts	19' 7"	21' 6"	3° Stbd.

General areas of flooding are the three after machinery spaces, No. 4 shaft alley, D-5-F, C-919-F, B-924-F, the after gyro room (D-501-A), B-913-W, B-914-W, B-915-W, B-919-W, B-920-W, B-921-W, and C-924-F. After gyro room flooded to a depth of three feet. The after engine room and after fireroom were flooded to a depth of about 8 feet by water.

Sources of flooding are broken salt water service line, a ruptured ballasting line, a fractured firemain riser, a corroded plug in a salt water cooling water discharge line to the ship's service generator, and opened shell seams in D-5-F. Progressive flooding has been permitted by main propulsion shaft bulkhead stuffing glands, open drain lines and sounding tubes.

ELECTRICAL

After engine room and after fire room flooded to a depth of eight feet. After gyro room flooded to a depth of three feet.

(b) Structural damage.

HULL

There appears to be no significant structural damage. There is some additional distortion of the main and second decks in the areas damaged during Test A. Stanchions below the well deck are more severely buckled than before and some which had previously been badly damaged are fractured.

MACHINERY

No comment.

ELECTRICAL

This item was not observed.

(c) Other damage.

HULL

There is no visible damage to machinery or electrical equipment except that caused by flooding. This would not have occurred if the ship had been manned. The forward AA Director is damaged and inoperable. The after AA Director is normal except for a slight binding caused apparently by corrosion. The AA switchboard which controls the AA Directors and the after 20mm battery has been flooded by a ruptured firemain. Flooding would not have occurred if the ship had been manned. The only damage to gunnery is a broken sight bracked in one of the after group of 20mm guns. Electronics equipment has been seriously affected by shock.

MACHINERY

Boilers # 5, 6, 7 and 8, #2 evaporating plant, and machinery in the after engine room were damaged by flooding. There was considerable damage to the casings and brickwork of all boilers. The main engines are apparently undamaged. However, the leads left in the bearings of # 4 main unit during the test indicate motion of the rotors sufficient to cause probable damage to the turbine blading and to the reduction gears if these units had been in operation during the test.

ELECTRICAL

All electrical equipment located in the lower level of the after engine room was disabled by flooding. Electrical circuits and equipment on the lower level of after fire room were disabled from flooding. All equipment located in the after gyro room was grounded from submersion.

II. Forces Evidenced and Effects Noted.

(a) Heat.

HULL

There is no evidence of heat.

MACHINERY

There was no evidence of heat.

ELECTRICAL

No evidence of heat was observed.

(b) Fires and explosions.

HULL

There have been no fires or explosions.

MACHINERY

There was no evidence of fires or explosions.

ELECTRICAL

There was no evidence of fires or explosions.

(c) Shock.

HULL

There is some evidence of shock and rapid movement of the ship. There are leaks in the overboard discharge valves in the after engine room. Floor plates are generally displaced in the machinery spaces. The forward AA Director and electronic equipment have also been damaged by shock.

MACHINERY

There was evidence, of rather heavy shock; viz., cracking and spalling of boiler brickwork; a few gages disarranged; floor plates loosened; breaking out of a plug in a salt water cooling line in the after engine room; motion up to .003 inch of main turbine rotors indicated by bearing leads. The shock apparently came from below and set up a whipping action causing some motion of the ship in both vertical and horizontal planes.

ELECTRICAL

A few small beads of mercury were observed within the binnacle of the forward gyro compass. It was not determined if this spillage was the result of shock or due to the heavy rolling of the vessel after the blast. The gyro was not affected by the loss of mercury. This condition was the only possible evidence of shock to any electrical equipment.

(d) Pressure.

HULL

There is very little damage that can definitely be attributed to pressure. The access trunk at frame 47 above the main deck has been crushed by air pressure. Pressure also possibly aggravated the damage to the well deck.

MACHINERY

There was considerable blast pressure, as evidenced by the fact that the boiler casings; which had been sprung apart by Test A, were sprung farther by Test B. Blast pressure also bent the flaps of the after forced draft blowers.

ELECTRICAL

There was no evidence of pressure.

(e) Effects apparently peculiar to the atom bomb.

HULL

With the exception of radioactivity, there are no effects peculiar to the atom bomb.

MACHINERY

The amount of shock and blast pressure experienced by a vessel at the range of the SALT LAKE CITY from an underwater explosion to be peculiar to the atom bomb.

ELECTRICAL

The high radioactivity was the only effect noted that was peculiar to the atom bomb.

III. Effects of Damage.

(a) Effect on machinery, electrical, and ship control.

HULL

There has been no additional damage to machinery and damage to ship control equipment is negligible. Boilers have been slightly damaged by shock. There is no visible damage to electrical equipment.

MACHINERY

The after fireroom and after engine room were made inoperable by flooding. It is not believed that this would have occurred if the crew had been aboard, as the flooding could have been controlled. Damage to the boilers would have left them operable (assuming that no flooding occurred) but would have reduced their steaming capacity by about 50%. This would have reduced the ship's maximum speed by

approximately 4 knots. The damage could have been temporarily repaired by the ship's force, one boiler at a time, while steaming, probably being completed within 2 days. If the main turbines had been in operation, they and the main reduction gears would probably have sustained some damage. The effect of this is conjectural but it might possibly have caused loss of all motive power.

From a machinery point of view, ship control was not appreciably affected by Test B.

ELECTRICAL

Failure of electrical equipment did not affect ship control or propulsion.

(b) Effect on gunnery and fire control.

HULL

The effect of the test on gunnery is negligible. The only serious damage to fire control equipment is the shock damage to the forward AA Director which has been rendered inoperable.

MACHINERY

No comment.

ELECTRICAL

There would have been no immediate effect on gunnery and fire control. However, the later flooding of the after gyro room would have disabled the after fire control switchboard.

(c) Effect on water-tight integrity and stability.

HULL

If personnel had been available to take corrective action, flooding could have been limited to tanks D-5-F, C-919-F, and C-924-F. The affect of this on stability would be negligible.

MACHINERY

No comment.

ELECTRICAL

None due to electrical failures.

(d) Effect on personnel and habitability.

HULL

There is no structural damage that affects personnel or habitability.

MACHINERY

There might have been a few casualties in fire-rooms if the ship had been in operation. Otherwise, the test would have had little, if any, effect on personnel in machinery spaces. Habitability was not affected except for radioactivity.

ELECTRICAL

There was no effect on personnel or habitability due to electrical failures.

(e) Total effect on fighting efficiency.

HULL

The fighting efficiency of the ship has been reduced approximately ten percent. This is due to the loss of the forward AA Director and to the damage to the boilers.

MACHINERY

Actually, the effect on fighting efficiency was to make the after engine room and after fireroom inoperable and to reduce

the steaming capacity of the forward boilers. Maximum speed under these conditions is estimated at 18-20 knots.

If the ship had been in operation during the test, maximum speed would have been temporarily reduced by at least 4 knots (by damage to boilers) and possibly to zero, depending on damage to main turbines and gears.

ELECTRICAL

Electrical failures other than flooding would not have affected the fighting efficiency of the vessel.

IV. General Summary of Observers' Impressions and Conclusions.

HULL

The ship has sustained only minor hull damage.

MACHINERY

In view of lack of opportunity to operate most of the machinery after Test B, or to open it for interior inspections, this report is based largely on visual exterior inspections. However, performance of such machinery as has been operated, and general conditions and appearance of the ship, are believed to warrant the conclusions contained herein.

ELECTRICAL

It is believed that had the ship been manned flooding would have been quickly controlled and no electrical damage would have occurred.

V. Preliminary General or Specific Recommendations of Inspection Group.

HULL

Shorter spacing should be provided between ventilation duct hanging brackets. Attention should be given to joints between sections of ventilation ducts.

The necessity for adequate shock mounting of electronic equipment has been emphasized by this test.

MACHINERY

As most of the machinery of this vessel is of obsolete design, recommendations based on it would not be pertinent to present designs. It should be noted that modern turbines have smaller bearing clearances than those of the SALT LAKE CITY and their rotors could not move as much relative to the stators as the SALT LAKE CITY's did. Modern boilers would have withstood the blast.

ELECTRICAL

The slight mercury splash in the Arma MK VIII Mod 3A gyro compass together with similar damage on other target vessels indicates a need for modification of the compass.

TECHNICAL INSPECTION REPORT

SECTION I - HULL

GENERAL SUMMARY OF HULL DAMAGE

I. Target Condition After Test.

(a) Drafts after test; list; general areas of flooding, sources.

	Forward	Aft	List
Before Test B Drafts	19' 3"	20' 6"	0°
After Test B Drafts	19' 7"	21' 6"	3° Stbd.

General areas of flooding are the three after machinery spaces, No. 4 shaft alley, D-5-F, C-919-F, B-924-F, the after gyro room (D-501-A), B-913-W, B-914-W, B-915-W, B-919-W, B-920-W, B-921-W, and C-924-F.

Sources of flooding are a broken salt water service line, a ruptured ballasting line, a fractured firemain riser, a corroded plug in a salt water cooling lin and opened shell seams in D-5-F. Progressive flooding has been permitted by main propulsion shaft bulkhead stuffing glands, open drain lines and sounding tubes.

(b) Structural damage.

There appears to be no significant structural damage. There is some additional distortion of the main and second decks in the areas damaged during Test A. Stanchions below the well deck are more severely buckled than before and some which had previously been badly damaged are fractured.

(c) Other damage.

There is no visible damage to machinery or electrical equipment except that caused by flooding. This would not have

occurred if the ship had been manned. The forward AA Director is damaged and inoperable. The after AA Director is normal except for a slight binding caused apparently by corrosion. The AA switchboard which controls the AA Directors and the after 20 MM battery has been flooded by a ruptured firemain. Flooding would not have occurred if the ship had been manned. The only damage to gunnery is a broken sight bracket in one of the after group of 20 MM guns. Electronics equipment has been seriously affected by shock.

II. Forces Evidenced and Effects Noted.

(a) Heat.

There is no evidence of heat.

(b) Fires and explosions.

There have been no fires or explosions.

(c) Shock.

There is some evidence of shock and rapid movement of the ship. There are leaks in the overboard discharge valves in the after engine room. Floor plates are generally displaced in the machinery spaces. The forward AA Director and electronic equipment have also been damaged by shock.

(d) Pressure.

There is very little damage that can definitely be attributed to pressure. The access trunk at frame 47 above the main deck has been crushed by air pressure. Pressure also possibly aggravated the damage to the well deck.

(e) Effects apparently peculiar to the atom bomb.

With the exception of radioactivity, there are no effects peculiar to the atom bomb.

III. Effects of Damage.

(a) Effect on machinery, electrical and ship control.

There has been no additional damage to machinery and damage to ship control equipment is negligible. Boilers have been slightly damaged by shock. There is no visible damage to electrical equipment.

(b) Effect on gunnery and fire control.

The effect of the test on gunnery is negligible. The only serious damage to fire control equipment is the shock damage to the forward AA Director which has been rendered inoperable.

(c) Effect on water-tight integrity and stability.

If personnel had been available to take corrective action, flooding could have been limited to tanks D-5-F, C-919-F, and C-924-F. The effect of this on stability would be negligible.

(d) Effect on personnel and habitability.

There is no structural damage that affects personnel or habitability.

(e) Effect on fighting efficiency.

The fighting efficiency of the ship has been reduced approximately ten percent. This is due to the loss of the forward AA Director and to the damage to the boilers.

IV. General Summary of Observers' Impressions and Conclusions.

The ship has sustained only minor hull damage.

V. Preliminary General or Specific Recommendations of Inspection Group.

Shorter spacing should be provided between ventilation duct hanging brackets. Attention should be given to joints between sections of ventilation ducts.

The necessity for adequate shock mounting of electronic equipment has been emphasized by this test.

VI. Instructions for loading the vessel specified the following:

ITEM	LOADING
Fuel Oil	Min.
Diesel Oil	Min.
Ammunition	10%
Salt water ballast	Full Load
Potable and reserve feed water	1600 tons

Details of the actual quantities of the various items aboard are included in Report 7, Stability Inspection Report, submitted by the ship's force in accordance with "Instructions to Target Vessels for Tests and Observations by Ship's Force" issued by the Director of Ships Material. This report is available for inspection in the Bureau of Ships Crossroads Files.

DETAILED DESCRIPTION OF HULL DAMAGE

A. General Description of Hull Damage.

(a & b) Overall condition of vessel and General Areas of Damage.

The overall condition of the ship is good. There has been some additional deflection of the main deck, frames 61-71, with resulting damage to stanchions immediately below.

Three firemain risers are ruptured in places that had been previously weakened by corrosion.

The access trunk at frame 47 between the main and superstructure decks is dished.

There is slow flooding in the three after machinery spaces and D-5-F.

General views of the exterior are shown on pages 59 to 86 inclusive.

(c) Apparent causes of hull damage in each area.

The access trunk at frame 47 has been damaged by blast. Deflection of the main deck is probably due to a combination of blast and falling water.

(d) Principal areas of flooding with sources.

The leakage into D-5-F is probably through a shell seam opened by the underwater shock wave. Flooding in the machinery spaces is due to progressive flooding through main propulsion shaft bulkhead stuffing boxes, and open drain lines. The reserve feed water tanks flooded through sounding tubes from the after fireroom.

(e) Residual strength, buoyancy, and effect of general condition of hull on operability.

The effect of the test on longitudinal strength is

slight. The ship took on 500 tons of water, but if personnel had been available to take corrective action, the amount would be much smaller. Operability of the ship has not been affected by hull damage.

B. Superstructure.

(a) Description of damage.

There has been no structural damage in the superstructure.

(b) Causes of damage in each area.

Not Applicable.

(c) Evidence of fire in the superstructure.

There is no evidence of fire in the superstructure.

(d) Estimate of relative effectiveness against heat and blast.

There is no basis for evaluating relative damage to the various types of structure.

(e) Constructive criticism of superstructure design or construction including important fittings and equipment.

No comment.

C. Turrets, Guns and Directors.

(a) Protected mounts.

No damage.

(b) Unprotected mounts.

1. General condition, including operability, if known.

No damage, except one sight bracket in the after

group of 20 MM guns was broken off due to decomposition of the metal itself.

2. Effectiveness and sufficiency of crew shelters.

Splinter shields are insufficient protection for the crew.

(c) Directors and range finders (in 8" mounts).

No damage.

(d) Constructive criticism of design or construction of mounts, directors, foundations and shelters.

Personnel manning the secondary battery should have more adequate protection from blast and radioactive water.

D. Torpedo Mounts, Depth Charge Gear.

Not Applicable.

E. Weather Deck.

(a) General condition of deck and causes of damage.

The general condition of the deck is good. Fracture of previously damaged stanchions below, indicate that the main deck has additional deflection in the well deck area and at frame 97. The deck deflection gages have maximum recordings of from 1 to 2 inches elastic deflection. Permanent set recordings are about 50 percent of this. These gages are not at the points of maximum deflection. The deflection is probably due to a combination of blast pressure and falling water. Pages 96 § 97 are a tabulation of scratch gage locations and recordings.

(b) Usability of deck in damaged condition.

The usability of the deck has not been affected.

(c) Condition of equipment and fittings.

There has been no damage to equipment or fittings.

F. Exterior Hull.

There has been no apparent damage to the exterior hull above the waterline.

G. Interior Compartments (Above the armor deck).

(a) Damage to structure and causes.

The only visible structural damage above the second (armor) deck is the fractured stanchions at frames 65, 68, and 97. (Photos 1718-8, 9, 10, 11, 12, 1710-1; pages 84 , 85 , 86 , 87 , 88 , and 89).

(b) Damage to joiner bulkheads and causes.

There has been no noticeable damage to joiner bulkheads.

(c) Details of damage to access closures and fittings.

There has been no damage to access closures and fittings.

(d) Condition of equipment within compartments.

There has been no damage to equipment.

(e) Evidence of fire.

There have been no fires.

(f) Damage in way of piping, cable, ventilation ducts, etc..

Shock caused failure of several ventilation duct joints and brackets. The damage is easily repairable. There is no damage to cables.

The firemain has been ruptured in the Marines Washroom (B-201-1, 2nd Deck, frames 49 to 51, starboard side) and the Recreation Compartment (2nd deck, frames 63 to 68, port side). In both places the piping had been badly weakened by corrosion before the test.

(g) Estimate of reduction in watertight subdivision, habitability and utility of compartments.

The effect on watertight subdivision, habitability, and utility of compartments is negligible.

H. Armor Decks and Miscellaneous Armor.

(a) Damage to armor deck and causes of damage.

There is no apparent damage to armor deck.

(b) Protection afforded spaces below.

The protection afforded is adequate.

(c) Condition around openings.

There is no damage to hatches, gratings, uptake bulkheads, and barbettes.

(d) Condition of connections to vertical armor.

The connections to the vertical armor have not been observed, but no damage is expected.

I. Interior Compartments (below w.l.).

(a) Damage to structure and causes.

There is no apparent structural damage to the interior compartments below the waterline.

(b) Damage to joiner bulkheads and causes.

There is no damage to joiner bulkheads.

(c) Details of damage to access closures and causes.

No damage has been observed to access closures.

(d) Condition of equipment within compartments.

Boiler casings ruptured in Test A are more severely buckled than before. The casings of boilers numbers 5 and 6, previously repaired, have again been ruptured. There is minor damage to brick and plastic in all boilers. The only other damage to equipment is from flooding. This would not have occurred had the ship been manned.

(e) Flooding.

There is slow flooding in the forward engine room, after boiler room, after engine room, and number 4 shaft alley.

(f) Damage in way of piping, cables, ventilation ducts, shafts, etc..

The firemain has been ruptured in the after gyro room, inner bottom, frames 97 to 102. The piping had been badly weakened by corrosion before the test. A ballasting line from B-924-F is ruptured. The bulkhead gland for shaft number four through bulkhead 97 has been damaged by shock. The shaft glands at bulkheads 72 and 85 are also damaged.

(g) Estimate of reduction in watertight subdivision, habitability, and utility of spaces.

It is believed that if personnel had been available to take corrective action, flooding would have been limited to D-5-F, C-919-F, and C-924-F. The habitability and utility of the spaces would then have been unimpaired.

J. Underwater Hull.

(a) Interior inspection of underwater hull.

There is no damage noticeable from the interior.

(b) Effect of damage on buoyancy, operability, or maneuverability.

There is no damage that would normally affect the operability or maneuverability of the ship. The affect on buoyancy would be negligible.

(c) Any known or suspected damage to shafts, propellers, struts, rudders, or external keels.

There is no damage known or suspected to the keel structure.

K. Tanks.

(a) Condition of tanks in area of damage.

D-5-F is apparently ruptured and opened to the sea.

(b) Contamination of liquids.

Water in the centerline and starboard reserve feed water tanks B-913-W, B-914-W, B-919-W, B-920-W, and B-921-W has increased from 95 to 100 percent of the tanks capacities. It is possible that these tanks are ruptured but more probable that they filled through the sounding tubes from the after fireroom. The contamination of these tanks reduces the feed water reserve by 50 percent. However, as they can probably be cleaned and used again, the ships operability should not be impaired.

(c) Damage (known or suspected) to torpedo defense system.

There is no damage known or suspected to the torpedo defense system.

L. Flooding.

The major sources of flooding are; a broken salt water service line, a ruptured ballasting line, a fractured firemain riser, a corroded plug in a salt water cooling line, the rudder stack gland, and opened shell seams in D-5-F. Progressive flooding is permitted by main propulsion shaft bulkhead stuffing boxes, open drain lines, sounding tubes, and an open vent on the main deck.

	Forward	Aft	
Before Test B Drafts	19' 3"	20' 6"	List 0°
After Test B Drafts	19' 7"	21' 6"	List 3° Stbd.

The vessel took on approximately 500 tons of water and listed 3° to starboard due to the flooding of D-5-F and the draining of B-924-F. A sketch showing the flooded spaces is on page 93 .

No. 4 shaft alley, D-506-E, partially flooded to a depth of 6 feet with approximately 20 tons of water. This water came from the after engine room through the shaft bulkhead gland. The shaft alley had been air tested in June, 1945, and at that time no air pressure could be put on the space. The other shaft alleys had no leakage. The after engine room has 11 feet of water, approximately 220 tons. This water came from a broken nipple to the relief valve on a salt water service line connected to No. 2 auxiliary condenser circulating line which had an open sea connection and from a broken out, corroded, 1-1/2 inch plug in the salt water service line to No. 2 main lube oil cooler. Water flooded from the after engine room into the after fireroom and into C-919-F. In addition, it was noted that all engine room sea valves have leakage around the valve stem glands.

The after fireroom has 7 feet of water, approximately 120 tons. This water came from the after engine room through shaft bulkhead glands, from a ruptured ballasting line which drained B-924-F, from the after engine room, via C-919-F through an open funnel drain from the fireroom to C-919-F, and from a pre-test leak in an inner bottom seam in way of B-923-F.

The forward engine room has 4 feet of water, approximately 60 tons. This water came from the after fireroom through shaft bulkhead glands and minor leakage through a few pin holes and a 4-inch crack in No. 1 main injection. No machinery was submerged or damaged by the flooding water.

The forward fireroom has no flooding. The after gyro room, D-501-A has 4 feet of water, approximately 20 tons. This water came from a ruptured firemain riser which permitted drainage of the firemain system into the compartment. When this space was air tested in July 1945, no pressure could be built up.

The steering gear void, D-421-V, had normal leakage over the period from disembarkation until return of the ships company. This permitted the void to be flooded to a depth of 5 feet, approximately 25 tons. This compartment had been air tested in March, 1946, and lost 32 ounces compared with an allowable drop of 2.5 to 0.5 ounces in 10 minutes.

The steering gear room, D-313-E, is partially flooded with approximately 20 tons of water. This water came through the rudder trunk packing. The compartment had been air tested in March, 1946, and had a loss of 12 ounces compared to an allowable drop of 10.0 to 0.5 ounces in 10 minutes. The rudder post leaked at a rate of about 3 feet of water per week.

Water in the centerline and starboard reserve feed tanks, B-913-W, B-914-W, B-915-W, B-919-W, B-920-W, and B-921-W, under the after fireroom, increased from 95 to 100 percent of tank capacity, approximately 10 tons. This water came from either ruptured shell seams or more probably from the after fireroom through the sounding tubes.

Fuel oil tank, B-924-F, abreast of the after fireroom, drained into the fireroom through a ruptured ballasting line. Fuel oil tank, C-919-F, flooded from the after engine room through an open line and contributed to further progressive flooding by leaking into the after fireroom through an open funnel drain line. Fuel oil tank, D-5-F, flooded from the pre-test loading to full capacity, adding approximately 20 tons of water through opened shell seams.

The following tanks remained dry; D-415-A, D-418-A, D-419-V, D-420-V, D-511-W, and D-512-W.

The laundry, D-302-E, was not flooded as a result of the test. However, the space was flooded at a later date through a vent opening on the main deck, presumably due to the high pressure washin- lown of the ship decontamination work.

Flooding caused by Test B is shown schematically on page 93 . The following of the various spaces was due primarily to causes that could have been controlled by damaged control parties or by personnel on watch in the engineering spaces. It is believed that had personnel been readily available to take corrective action, flooding could have been limited to D-5-F, C-919-F, C-924-F, and that the other aces would have had enter only a small amount of water which could have been easily handled by routine operation of ships pumps.

M. Vent ion (exclusive of blowers).

(a) Damage to ventilation systems and causes.

Several ventilation ducts, joints, and hanging brackets have failed. This was apparently caused by shock. The effect on habitability is negligible as this damage can easily be repaired by the ship's force.

(b) Evidence that ventilation systems conducted heat, blast, fire, or smoke below decks.

No evidence.

(c) Evidence that ventilation systems allowed progressive flooding.

No evidence.

(d) Constructive criticism and design and construction of system.

In order to withstand shock, more adequate hanging brackets should be provided and the duct joints should be strengthened.

N. Ship Control.

(a) Damage to ship control stations and causes.

Some electronics equipment in the CIC room, on the superstructure deck, centerline, between bulkheads 38 and 44, has been damaged by shock.

Both gyro compasses have lost some mercury. In the after gyro room, the 17 MC amplifier is partially submerged and totally grounded out. The 1 MC relay control is broken but is operative with the amplifier continually energized.

(b) Constructive criticism of ship control systems.

The cables in the after gyro room should be on the overhead rather than in the bilges to avoid being grounded.

O. Fire Control.

(a) Damage to fire control stations and causes.

1. Directors and elevated control stations.

There is no significant damage to the main battery directors.

The forward AA Director was damaged by shock and is jammed in train after shifting to starboard and aft off the roller path. One accessible holding down clip is found to be sheared. The stable element is damaged. Several knobs and cranks on the range keeper are inoperable due to corrosion probably caused at time of decontamination of the ship.

The after AA Director is normal except that corroded level gearing to the telescope causes slight binding.

2. Plot rooms and protected spaces.

This ship has no plotting room but the AA switchboard which controls the AA Directors as well as the after 20 MM gun battery was flooded due to the rupturing of a fire main which had been previously weakened by corrosion. This leak would have been quickly discovered and stopped if the ship had been manned.

(b) List of stations having insufficient protection and estimated effect on fighting efficiency of the loss of each.

The loss in fighting efficiency of the ship due to the loss of the forward AA Director would have been small because all of the AA batteries could have been controlled by the undamaged after AA Director. It is also doubtful if personnel manning the 40 MM and 20 MM stations would have been immediate casualties. However, these stations may have been untenable due to radioactivity.

(c) Constructive criticism of location and arrangement of stations.

Insofar as the direct effects of the blast are concerned the location and arrangement of stations may be considered satisfactory. Shields or other means must be provided for the crew to combat the effects of radioactivity.

P. Ammunition Behavior.

(a) Ready service ammunition, location, protection, behavior under heat and blast.

Satisfactory, except that there is some slight damage to ready service boxes for the secondary battery located topside.

(b) Magazines, location, protection, forces involved, behavior.

Satisfactory.

(c) List of stowages which are insufficiently protected and effects on ship survival of explosion of each stowage.

All stowages appear to be sufficiently protected although ready service boxes for the secondary battery on the top side are rather lightly constructed and susceptible to blast damage. Any explosion in these stowages would only cause local damage and not greatly threaten the survival of the ship.

(d) Behavior of gasoline stowage facilities.

Not affected.

Q. Ammunition Handling.

(a) Condition and operability of ammunition handling devices.

No damage.

(b) Evidence that any ammunition handling device contributed to passing of heat, fire, blast on flooding water.

None.

(c) Constructive criticism of design and construction of ammunition handling devices.

No comment.

R. Strength.

(a) Permanent hog or sag.

There is no evidence of permanent hog or sag.

(b) Sheer strains in hull plating.

There are no visible shear strains in the hull plating.

(c) Evidence of transverse or racking strains.

No evidence.

(d) Details of any local failures in way of structural discontinuties.

There was no local failures.

(e) Evidence of panel deflection under blast.

The only evidence of panel deflection under blast is the mild deflection of the well deck and dishing of the access trunk above the main deck at frame 47.

(f) Turrets, machinery, and gun foundations.

There is no damage to turrets, machinery foundations, or gun foundations.

S. Miscellaneous.

(a) Evidence of heat damage variations under various colors of camouflage painting.

There is no evidence of any damage due to heat.

(b) Other miscellaneous effects or condition noted during inspection.

No other miscellaneous effects have been noted.

TECHNICAL INSPECTION REPORT

SECTION II - MACHINERY

GENERAL SUMMARY OF MACHINERY DAMAGE

I. Target Condition After Test.

(a) Drafts after test; list; general areas of flooding, sources.

The after engine room and after fireroom were flooded to a depth of about 8 feet by water entering through a leak in a cooling water discharge line to the ship's service generator in the after engine room. The water apparently entered the after fireroom from the after engineroom via non-watertight bulkhead fittings. No appreciate shaft gland leakage was found.

(b) Structural damage.

No comment.

(c) Other damage.

Boilers #5, 6, 7, and 8, #2 evaporating plant, and machinery in the after engine room were damaged by flooding. There was considerable damage to the casings and brickwork of all boilers. The main engines are apparently undamaged. However, the leads left in the bearings of #4 main unit during the test indicate motion of the rotors sufficient to cause probable damage to the turbine blading and to the reduction gears if these units had been in operation during the test.

II. Forces Evidenced and Effects Noted.

(a) Heat.

There was no evidence of heat.

(b) Fires and explosions.

There was no evidence of fires or explosions.

(c) Shock.

There was evidence of rather heavy shock; viz., cracking and spalling of boiler brickwork; a few gages disarranged; floor plates loosened; breaking out of a plug in a salt water cooling line in the after engine room; motion up to .033 inch of main turbine rotors indicated by bearing leads. The shock apparently came from below and set up a whipping action causing some motion of the ship in both vertical and horizontal planes.

(d) Pressure.

There was considerable blast pressure, as evidenced by the fact that the boiler casings, which had been sprung apart by Test A, were sprung farther by Test B. Blast pressure also bent the flaps of the after forced draft blowers.

(e) Any effects apparently peculiar to the Atom Bomb.

The amount of shock and blast pressure experienced by a vessel at the range of the Salt Lake City from an underwater explosion appears to be peculiar to the Atom Bomb.

III. Effects of Damage.

(a) Effect on machinery, electrical, and ship control.

1. Actually, the after fireroom and after engine room were made inoperable by flooding. It is not believed that this would have occurred if the crew had been aboard, as the flooding could have been controlled. Damage to the boilers would have left them operable (assuming that no flooding occurred) but would have reduced their steaming capacity by about 50%. This would have reduced the ship's maximum speed by approximately 4 knots. The damage could have been temporarily repaired by the ship's force, one boiler at a time, while steaming, probably being completed within 2 days. If the main turbines had been in operation, they and the main reduction gears would probably have sustained some damage. The effect of this is conjectural but it might possibly have caused loss of all motive power.

2. From a machinery point of view, ship control was not appreciably affected by Test "B".

(b) Effect on gunnery and fire control.

No comment.

(c) Effect on water-tight integrity and stability.

No comment.

(d) Effect on personnel and habitability.

There might have been a few casualties in firerooms if the ship had been in operation. Otherwise, the test would have had little, if any, effect on personnel in machinery spaces. Habitability was not affected except for radioactivity.

(e) Total effect on fighting efficiency.

1. Actually, the effect on fighting efficiency was to make the after engine room and after fireroom inoperable and to reduce the steaming capacity of the forward maximum speed. Under these conditions is estimated at 18 to 20 knots.

2. If the ship had been in operation during the test, maximum speed would have been temporarily reduced by at least 4 knots (by damage to boilers) and possibly to zero, depending on damage to main turbines and gears.

IV. General Summary of Observers Impressions and Conclusions.

In view of lack of opportunity to operate most of the machinery after Test "B", or to open it for interior inspection, this report is based largely on visual exterior inspections. However, performance of such machinery as has been operated, and general conditions and appearance of the ship, are believed to warrant the conclusions contained herein.

V. Any Preliminary General or Specific Recommendations of The Inspecting Group.

As most of the machinery of this vessel is obsolete design, recommendations based on it would not be pertinent to present designs. It should be noted that modern turbines have smaller bearing clearances than those of the Salt Lake City and their rotors could not move as much relative to the stators as the Salt Lake City's did. Modern boilers would have withstood the blast pressure better than those of this vessel, but would probably have received similar damage to brickwork from shock.

DETAILED DESCRIPTION OF MACHINERY DAMAGE

A. General Description of Machinery Damage.

(a) Overall condition.

The after fire room and engine room were flooded to a depth of about 8 feet by the failure of a plug in a cooling line (See item "V"). This put the two spaces out of commission. However, this flooding and damage could have been prevented if the crew had been aboard. There was considerable damage to boiler casings and moderate damage to brickwork.

(b). Areas of major damage.

Primary major damage was confined to the boilers. The after fire room and engine room had secondary major damage from flooding.

(c) Primary causes of damage.

Flooding. Other damage was caused by shock and blast pressure.

(d) Effect on target test on overall operation of machinery plant.

Actually, the after fire room and engine room were made inoperable by flooding. If the crew had been aboard to control the flooding, it is not believed that any machinery would have been affected by flooding. However, damage to boilers would have reduced steaming capacity by approximately 50% (reducing maximum speed by about 4 knots) until temporary repairs could be made. Also, it is considered probable that the main turbines and gears would have been damaged if they had been in operation, possibly causing loss of all motive power.

Note: None of the main propelling machinery and comparatively little of the auxiliary machinery on this vessel were operated under power after test "B" as radiological hazard forced her abandon-

ment before boiler power was restored. Only two boilers were repaired sufficiently to allow operation after test "A", and these were flooded and again damaged during test "B". Therefore, most of the data for this report was obtained by visual inspection only.

B. Boilers.

1. The boilers' casings had been extensively damaged by test "A" and therefore the estimate of the effects of test "B" on these boilers is highly conjectural. It is believed that the damage to boilers in good condition would not have been severe enough to cause complete loss of steam, although boiler capacity would have been reduced due to damage to casings. It is estimated that the vessel would have had not less than 50% boiler capacity remaining, and that full steaming capacity could have been regained as the crew had opportunity to make repairs, if the boilers had been in good condition before test "B".

2. The after fire room was flooded to a depth of 4 feet above the floor plates and all boilers in this space were made inoperable as a result. It is not believed that this would have occurred if the crew had been aboard.

(a) Air casings.

On no. 1, 2, 3 and 4 boilers, the side casings, which had been ruptured by test "A", were pushed outward still further. This is particularly noticeable on no. 4 boiler, on which the front casing is also pushed outward. On #5 and 6 boilers, which had been repaired by welding the openings in the casings, the welded portion was sprung open about 2 inches. The welding job was a hasty one. It is not believed that an undamaged boiler would have been appreciably damaged here. No. 7 and 8 boilers were not appreciably affected. This is probably due to the fact that the uptakes of these boilers were closed by plates after test "A", preventing blast pressure from entering the boilers. (See photos 4060-2 and 4060-3, pages 90 , and 91 .

(b) External fittings.

No apparent damage.

(c) Fuel oil assemblies.

No apparent damage.

(d) Brickwork and furnaces.

There was considerable cracking and spalling of brickwork and some falling of brickwork and plastic in all boilers, but not enough to seriously impair operation. No. 5, 6, 7 and 8 boilers were flooded when the after fireroom flooded from the after engine room. No. 6 boiler was subsequently dried out and steam was raised.

(e) Steam, water drums and headers.

No apparent damage. No hydrostatic test has been placed on any boiler after test "B", however, the seven boilers that had water in them during the test had the same amount of water remaining after the test.

(f) Tubes.

No apparent damage.

(g) Foundations.

No apparent damage.

(h) Stacks and uptakes.

No apparent damage.

Note: No hydrostatic tests were conducted after test "B" due to radio-activity. However, a visual inspection revealed no damage to the pressure parts of any boiler.

C. Blowers.

The flaps of the after blowers were sprung slightly, otherwise there was no apparent damage to the forced draft blowers.

All of them have been turned freely by hand since test "B".

D. Fuel Oil Equipment.

There was no apparent damage to fuel oil equipment. The equipment for #5 boiler has been used since test "B".

E. Boiler Feedwater Equipment.

There was no apparent damage to feedwater equipment. The equipment for boiler #5 has been used since test "B".

F. Main Engines.

1. There was no apparent damage to the main engines. Lead readings indicate movement of the rotors up to .033 in the vertical plane, and considerable motion in the horizontal plane (see bearing lead data). The movement of rotors thus indicated is such that it is considered probable that damage to the blading would have resulted if the turbines had been in operation at the time of the test.

2. The jacking gear motors of #2 and #3 engines were grounded out when the after engine room was partially flooded. This could have been prevented if the crew had been aboard. In an emergency, the turbines could be placed in operation without the use of the jacking gear.

BEARING LEAD DATA

#4 MAIN ENGINE L.P. TURBINE - FORWARD BEARING

Forward lead	Before Test "B"	After Test "B"	Difference
Port	.020	.007	.013
Top	.024	.007	.017
Stbd	.015	.006	.009
Center lead			
Port	.0165	.006	.0105

Top	.0235	.010	.0135
Stbd	.011	.005	.006
After lead			
Port	.020	.0065	.0135
Top	.0275	.014	.0135
Stbd	.016	.0065	.0095

#4 MAIN ENGINE L.P. TURBINE - AFTER BEARING

Forward lead			
Port	.027	.011	.016
Top	.033	.007	.026
Stbd	.0205	.007	.0135
Center lead			
Port	.0225	.009	.0135
Top	.0335	.008	.0255
Stbd	.022	.007	.015
After lead			
Port	.021	.009	.012
Top	.036	.007	.029
Stbd	.028	.006	.022

#4 MAIN ENGINE - H.P. TURBINE - FORWARD BEARING

Forward lead			
Port	.0215	.010	.0115
Top	.041	.008	.033
Stbd	.0175	.007	.0105
Center lead			
Port	.021	.008	.013
Top	.0275	.010	.0175
Stbd	.019	.007	.012
After lead			
Port	.0215	.008	.0135
Top	.0285	.010	.0185
Stbd	.020	.006	.014

Forward lead	Before test "B"	After test "B"	Difference
Port	.0195	.0085	.011
Top	.029	.0135	.0155
Stbd	.0175	.006	.0115
Center lead			
Port	.0185	.0075	.011
Top	.030	.013	.017
Stbd	.0195	.009	.0105
After lead			
Port	.016	.005	.011
Top	.029	.014	.015
Stbd	.021	.012	.009

G. Reduction Gears.

There was no apparent damage to the reduction gears. However, attention is invited to the considerable motion of the gears indicated by the bearing lea(data (see below). The movement indicated is such that it is considered probable that the gears would have been damaged if they had been in operation during the test.

#4 REDUCTION GEAR - L.P. PINION - FORWARD BEARING

Forward lead	Before test "B"	After test "B"	Difference
Port	.025	.009	.016
Top	.035	.010	.025
Stbd	.0195	.009	.0105
Center lead			
Port	.024	.006	.018
Top	.0355	.010	.0255
Stbd	.0195	.006	.0135
After lead			
Port	.019	.006	.013
Top	.035	.011	.024
Stbd	.019	.006	.013

#4 REDUCTION GEAR - L.P. PINION - AFTER BEARING

Forward lead	Before test "B"	After test "B"	Difference
Port	.0185	.007	.0115
Top	.028	.010	.018
Stbd	.021	.006	.015
Center lead			
Port	.018	.008	.010
Top	.027	.008	.019
Stbd	.017	.004	.013
After lead			
Port	.021	.009	.012
Top	.0265	.010	.0165
Stbd	.017	.006	.011

#4 REDUCTION GEAR - H.P. PINION - FORWARD BEARING

Forward lead			
Port	.013	.0045	.0085
Top	.0235	.0075	.016
Stbd	.023	.0095	.0135
Center lead			
Port	.014	.0065	.0075
Top	.0255	.0085	.017
Stbd	.027	.009	.018
After lead			
Port	.015	.0085	.0065
Top	.027	.012	.015
Stbd	.020	.006	.014

#4 REDUCTION GEAR - H.P. PINION - AFTER BEARING

Forward lead			
Port	.022	.004	.018
Top	.0305	.012	.0185
Stbd	.024	.012	.012

	Before test "B"	After test "B"	Difference
Center lead			
Port	.0175	.004	.0135
Top	.029	.009	.020
Stbd	.0245	.006	.0185
After lead			
Port	.020	.005	.015
Top	.029	.008	.021
Stbd	.024	.005	.019

H. Shafting and Bearings.

There was no apparent damage to the shafting and bearings.

I. Lubrication System.

There was no apparent damage to the lubrication system, except that incident to flooding of the after engine room. This could have been prevented if the crew had been aboard.

J. Condensers and Air Ejectors.

There was no apparent damage to the condensers and air ejectors. No. 4 main condenser and the after auxiliary condenser had their injection and overboard valves open during test "B".

K. Pumps.

1. The following pumps are inoperable because of partial flooding of the after engine room and after fireroom. Otherwise, there was no apparent damage to any of the pumps.

#2 lube oil purifier pump.
#2 fire and flushing pump.
After dynamo condensate pump.
After dynamo circulating pump.

2. A few pumps on this vessel were operated after test "B" and no defects were found.

L. Auxiliary Generators (Turbine and Gears).

There was no apparent damage to the auxiliary generators. The two forward ones have been jacked since test "B" and turned freely.

M. Propellers.

The propellers have not been inspected since test "B", however, there is no reason to believe that they were damaged.

N. Distilling Plant.

There was no apparent damage to the distilling plant except damage to #2 evaporator set incident to the flooding of the after fireroom.

O. Refrigerating Plant.

There was no apparent damage to the refrigerating plant.

P. Winches, Windlasses and Capstans.

There was no damage to the equipment included in this item. Both deck winches and the anchor engine have been operated satisfactorily since test "B".

Q. Steering Engine.

The steering equipment was not damaged. It has been operated with the rudder disconnected since test "B".

R. Ammunition Hoists, Elevators, Cranes, Etc.

1. No damage.

2. The ammunition hoists have been operated satisfactorily since test "B".

3. The crane was damaged by test "A". Temporary repairs were made to make it operable. No damage was done to it by test "B".

S. Ventilation.

1. No damage.

2. All ventilation machinery has been operated satisfactorily since test "B".

T. Air Compressors.

There was no apparent damage to the air compressors.

U. Diesels (Generators and Boats).

1. There was no damage to the diesel generators, both of which have been operated satisfactorily since test "B".

2. The diesel fire pump was not damaged by test "B". It was made inoperable by the shorting out of an electric starting lead.

V. Piping.

(a) Main steam.

Four main steam gages in the after engine room had their pointers driven past the stop pins. There was no other apparent damage to the main steam line.

(b) Auxiliary steam.

No apparent damage.

(c) Auxiliary exhaust.

No apparent damage.

(d) Condensate and feedwater.

No apparent damage.

(e) Fuel.

No apparent damage.

(f) Lube oil.

No apparent damage.

(g) Firemain, sprinkling, and water curtain.

No apparent damage.

(h) Condenser circulating water.

A plug in the ship's service generator oil cooling water discharge line in the after engine room broke out, allowing the after engine room and after fireroom to flood to a depth of about 8 feet during the six days the crew were off the ship. This plug had corroded almost through before the test. There was no other apparent damage to this system.

(i) Drain.

No apparent damage.

(j) Compressed air.

No apparent damage.

(k) Hydraulic.

No apparent damage.

(1) Gasoline.

No apparent damage.

W. Miscellaneous.

(a) Gasoline stowage and equipment.

No apparent damage.

(b) Messing machinery.

No apparent damage.

(c) Messing equipment.

No apparent damage to installed units. Portable units not secured were thrown around by the shock.

(d) Laundry equipment.

No apparent damage.

(e) Machine shop.

No apparent damage.

TECHNICAL INSPECTION REPORT

SECTION III - ELECTRICAL

GENERAL SUMMARY OF ELECTRICAL DAMAGE

I. Target Condition After Test.

(a) Drafts after test; list; general areas of flooding, sources.

After engine room and after fire room flooded to a depth of eight feet. After gyro room flooded to a depth of three feet.

(b) Structural damage.

This item was not observed.

(c) Other damage.

All electrical equipment located in the lower level of the after engine room was disabled by flooding. Electrical circuits and equipment on the lower level of after fire room were disabled from flooding. All equipment located in the after gyro room was grounded from submersion.

II. Forces Evidenced and Effects Noted.

(a) Heat.

No evidence of heat was observed.

(b) Fires and explosions.

There was no evidence of fires or explosions.

(c) Shock.

A few small beads of mercury were observed within the binnacle of the forward gyro compass. It was not determined if this

spillage was the result of shock or due to the heavy rolling of the vessel after the blast. The gyro was not affected by the loss of mercury. This condition was the only possible evidence of shock to any electrical equipment.

(d) Pressure.

There was no evidence of pressure.

(e) Any effects apparently peculiar to the atom bomb.

The high radioactivity was the only effect noted that was peculiar to the atom bomb.

III. Effects of Damage.

(a) Effect on propulsion and ship control.

Failure of electrical equipment did not affect ship control or propulsion.

(b) Effect on gunnery and fire control.

There would have been no immediate effect on gunnery and fire control. However, the later flooding of the after gyro room would have disabled the after fire control switchboard.

(c) Effect on water-tight integrity and stability.

None due to electrical failures.

(d) Effect on personnel and habitability.

There was no effect on personnel or habitability due to electrical failures.

(e) Total effect on fighting efficiency.

Electrical failures other than flooding would not have affected the fighting efficiency of the vessel.

IV. General Summary of Observers' Impressions and Conclusions.

It is believed that had the ship been manned flooding would have been quickly controlled and no electrical damage would have occurred.

V. Any Preliminary General or Specific Recommendations of the Inspecting Group.

The slight mercury splash in the Arma MK VIII MOD 3A gyro compass together with similar damage on other target vessels indicates a need for modification of the compass.

DETAILED DESCRIPTION OF ELECTRICAL DAMAGE

A. General Description of Electrical Damage.

(a) Overall condition.

The overall condition of the ship's electrical system was good, except for equipment which was damaged and disabled by flooding.

(b) Areas of major damage.

The areas of the only appreciable damage were those spaces in which flooding occurred. These were the forward engine room, after fire room, after engine room, #4 shaft alley and the after gyro room.

(c) Primary causes of damage in each area of major damage.

Immersion was the only cause of damage.

(d) Effect of target test on overall operation of electric plant.

1. Ship's service generator plant - generator #3 and #4 in the after engine room were disabled by flooding of the balancing coils.

2. Engine and boiler auxiliaries - the fire and flushing pump, lubricating oil purifier, jacking gear #2 and #3, and auxiliary condenser, air ejector circulating pump motors; and the lubricating oil purifier controller in the after engine room were grounded out by immersion.

3. Communications - the 17 MC announcing system was put out of service by flooding of amplifier but no other communication on the ship was affected.

4. Fire Control Circuits - Circuits coming from the fire control board in the after gyro room were grounded out.

5. Ventilation - no ventilation sets were affected.

6. Lighting - the flooded machinery spaces lost lighting in the lower level, no other lighting was affected.

(e) Types of equipment most affected.

Motors, controllers, cable and minor wiring appliances were grounded out by immersion in flooded spaces. Almost all damage to electrical gear was the result of flooding. However, the flooding occurred very slowly so that all such damage, although valid Test B secondary damage, would not have occurred if damage control parties had been available.

B. Electric Propulsion Rotating Equipment.

This item does not apply to the vessel.

C. Electric Propulsion Control Equipment.

This item does not apply to the vessel.

D. Generators - Ships Service.

1. The two 240/120 V. DC turbo generators in the after engine room were not damaged by wetting or otherwise. Although flooding following the B test occurred to within a few feet of the machines. The two balancing coils for each machine, four in all, located on the level below the generators were grounded by immersion as were the generator feeder cables to the switchboard.

2. The two DC generators in the forward engine room were not damaged. The machines were not operated after the test, but a ground reading of the winding was satisfactory.

3. No recommendations are made for this item.

E. Generators - Emergency.

1. No damage to either of the two emergency diesel generator sets was found on inspection after Test B. The ship's force operated both sets normally with no difficulty.

2. No recommendations are made on this item.

F. Switchboards, Distribution and Transfer Panels.

1. The forward and after ship's service switchboards were not damaged by the effects of Test B, although had the flooding of the after engine room occurred in a seaway the after board would have been wet by splashing. The forward board functioned normally in service after the test.

2. The emergency switchboards and panels, other than fire control, throughout the vessel, were found to have been undamaged by Test B.

3. No recommendations are made on this item.

G. Wiring, Wiring Equipment and Wireways.

1. There was no damage to wiring or wiring equipment other than that caused by flooding, resulting from test B.

2. Wireways in the lower level of the after engine room were wet by splash and immersion and approximately 50% of the cables in these wireways had grounds.

3. Cables running on the deck of the after gyro room were immersed in 3 feet of water. These cables included fire control, gun firing, and after gyro feeders. The cables actually grounded in this group are not known.

4. No appreciable damage to cables on the weather decks was caused by Test B.

5. Flooding in after gyro room was caused by a broken fire main, however, flooding did not occur until after reboarding by the crew.

6. No recommendations are made on this item.

H. Transformers.

1. Transformers through the ship were undamaged by the B test. Transformers in the after gyro room were wet by spray and were not tested, but do not appear to have been damaged. Ref. Item G of this report

2. No recommendations are made on this item.

I. Submarine Propelling Batteries.

This item does not apply to the ship.

J. Portable Batteries.

No portable batteries were damaged in any way as a result of Test B There was no shifting, cracking, acid spillage or other effects noted after the test.

K. Motors, Motor Generator Sets and Motor Controllers.

1. No damage to motors, motor generator sets and motor controllers other than immersion was caused by Test B. In the after engine room, the motors for the fire and flushing pump, lubricating oil purifier, jacking motors #2 and #3, the motor for the combined air ejector and circulating pump for the auxiliary condenser, and the controller for the lubricating oil purifier were flooded.

2. In the after gyro room the 50 KVA M-G set #2 for F.C. and I.C. service and the gyro compass M-G were flooded.

3. All vent sets and a number of other motors tested satisfactorily.

L. Lighting Equipment.

1. There was no damage to lighting equipment caused by the B test except that caused by flooding. Switches and junction boxes in the lower level of the after fireroom and after engine room were flooded, grounding out the lighting circuits in those spaces.

2. No recommendations are made on this item.

M. Searchlights.

There was no damage to searchlights resulting from the test.

N. Degaussing Equipment.

Neither of the two degaussing motor-generator sets and associated controls were damaged by the B test. No damage to the degaussing cables was observed.

O. Gyro Compass Equipment.

Both the forward and the after master gyros, Arma Mark VIII Mod 3A probably received moderate shock at time of test B. There was a slight loss of mercury but no mechanical damage in both compasses. The forward gyro was started up after the blast and operated properly. The after gyro had the cables leading into the bottom of the binnacle flooded and grounded out. Ref. Item G of this report.

P. Sound Powered Telephones.

One sound powered telephone, a hand set Type L, exposed on the open bridge, was found to be grounded out after the B test. The trouble could have been caused either by the water thrown by the blast, or by the flushing water used subsequently.

Not all phones were inspected but representative phones were tested out.

Q. Ship's Service Telephones.

There was no damage to ship's service telephones from the B test.

R. Announcing System.

The flooding of the after gyro room partially submerged the 17MC amplifier, grounding out the system.

The IMC relay control was found inoperative after the test but the system was operative with the transmitter continuously energized. The exact cause or nature of the trouble is not known.

No other damage to announcing systems, caused by B test, was found.

S. Telegraphs.

There was no visible damage to telegraph systems caused by the B test.

T. Indicating Systems.

The B test caused no visible damage to indicating systems.

U. I.C. and A.C.O. Switchboards.

No damage was caused to the I.C. and A.C.O. switchboards by the B test.

V. F.C. Switchboard.

The forward F.C. switchboard was not damaged by the B test. The after F.C. switchboard had the leads passing into the bottom immersed and grounded out by the flooding of the after gyro room.

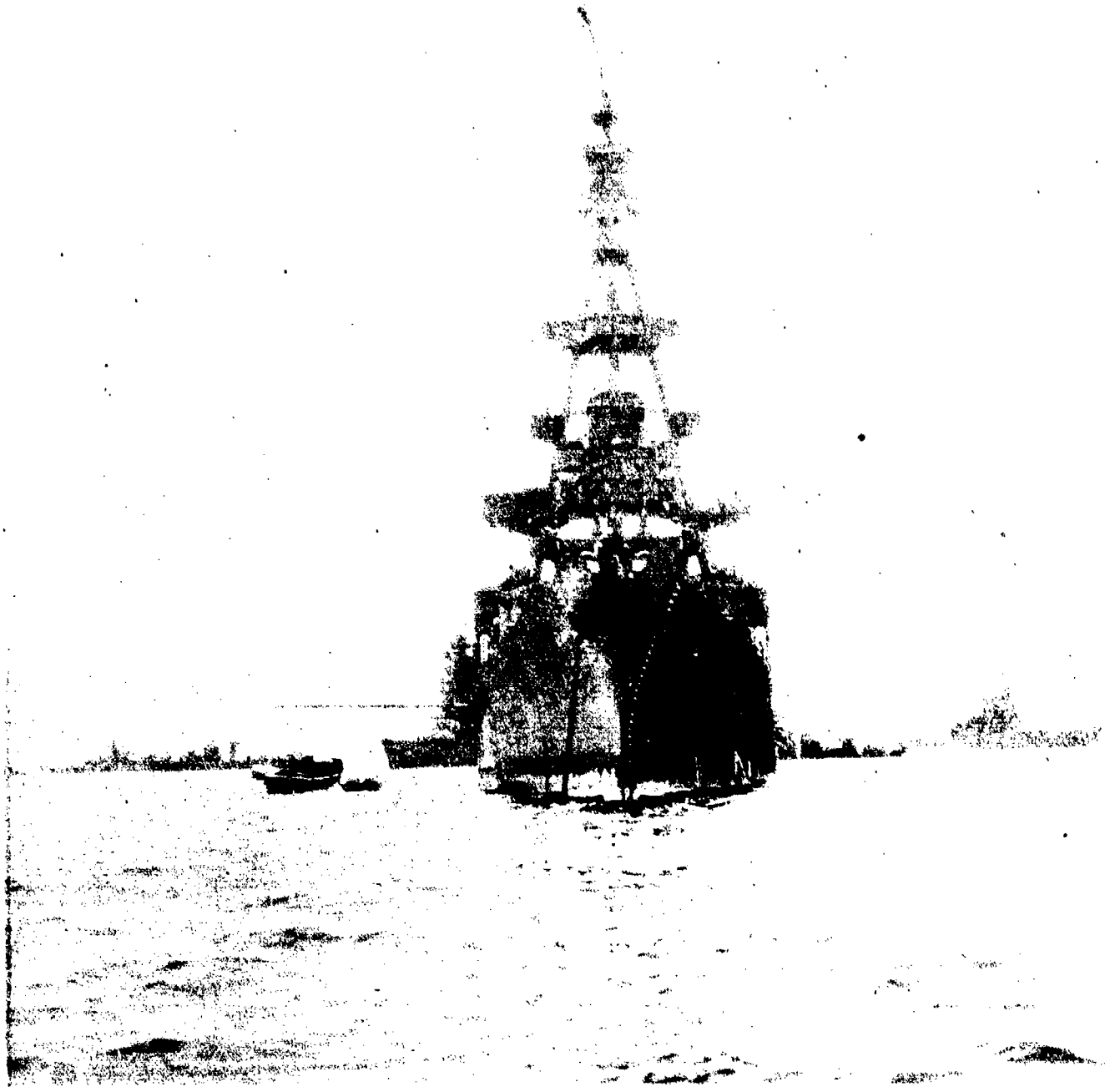
W. Miscellaneous.

A number of special electrical items including lighting fixtures, lamps, motors, controllers, and other gear was installed on the vessel for the two atomic bomb tests. None of this gear was damaged by the B test, except where flooded out.

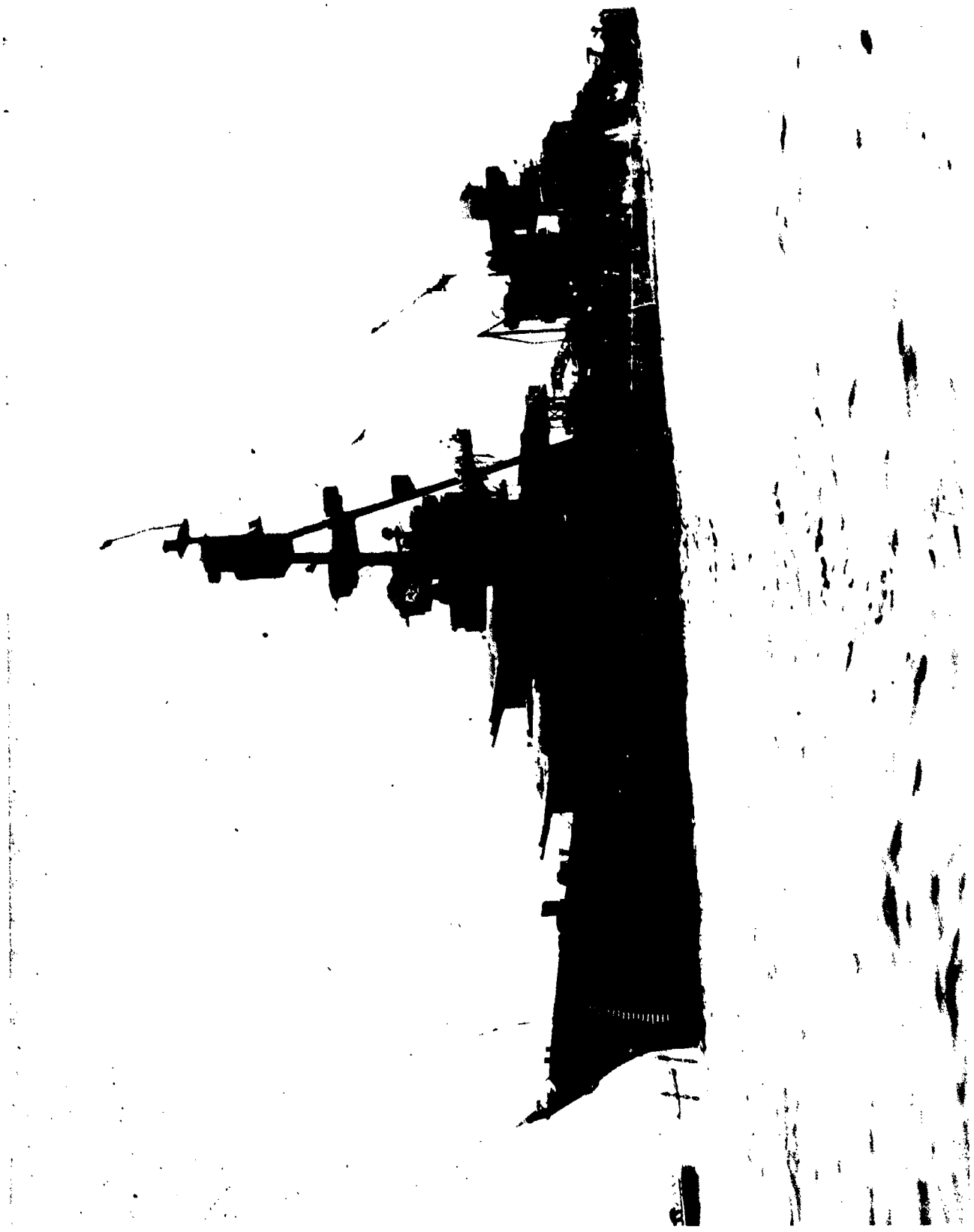
SECTION IV

PHOTOGRAPHS

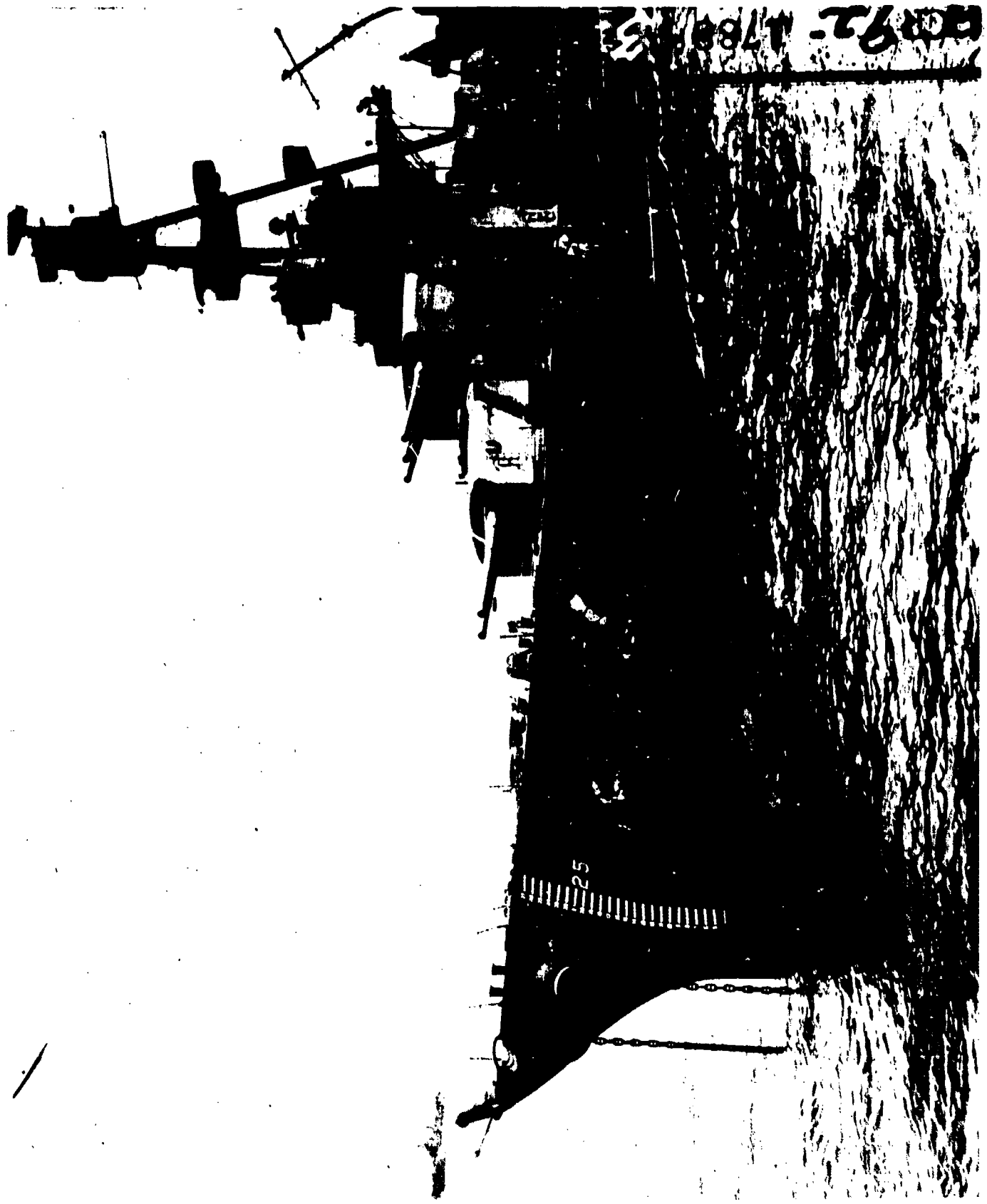
TEST BAKER



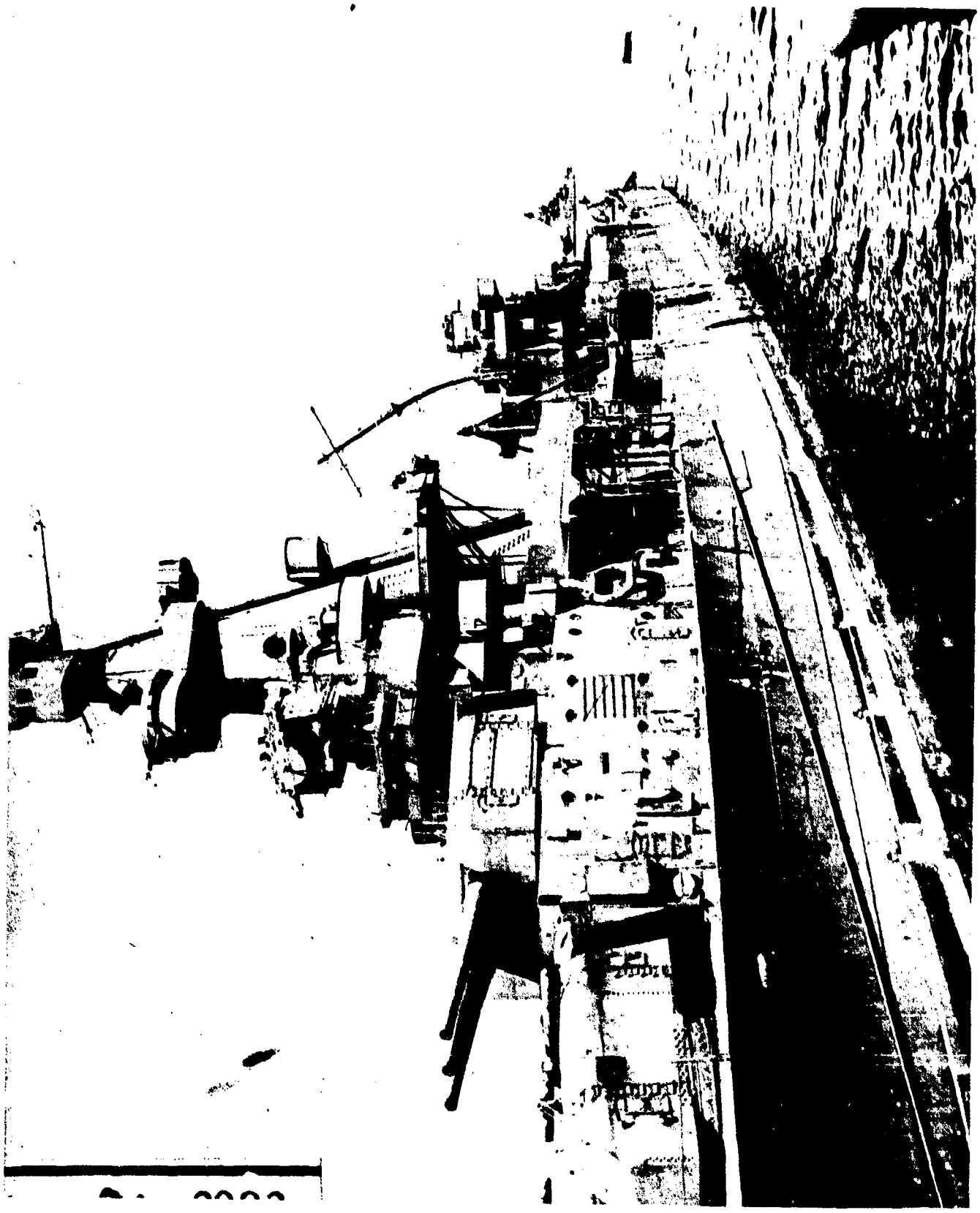
BB-CR-227-519-19. View from ahead before Test B.



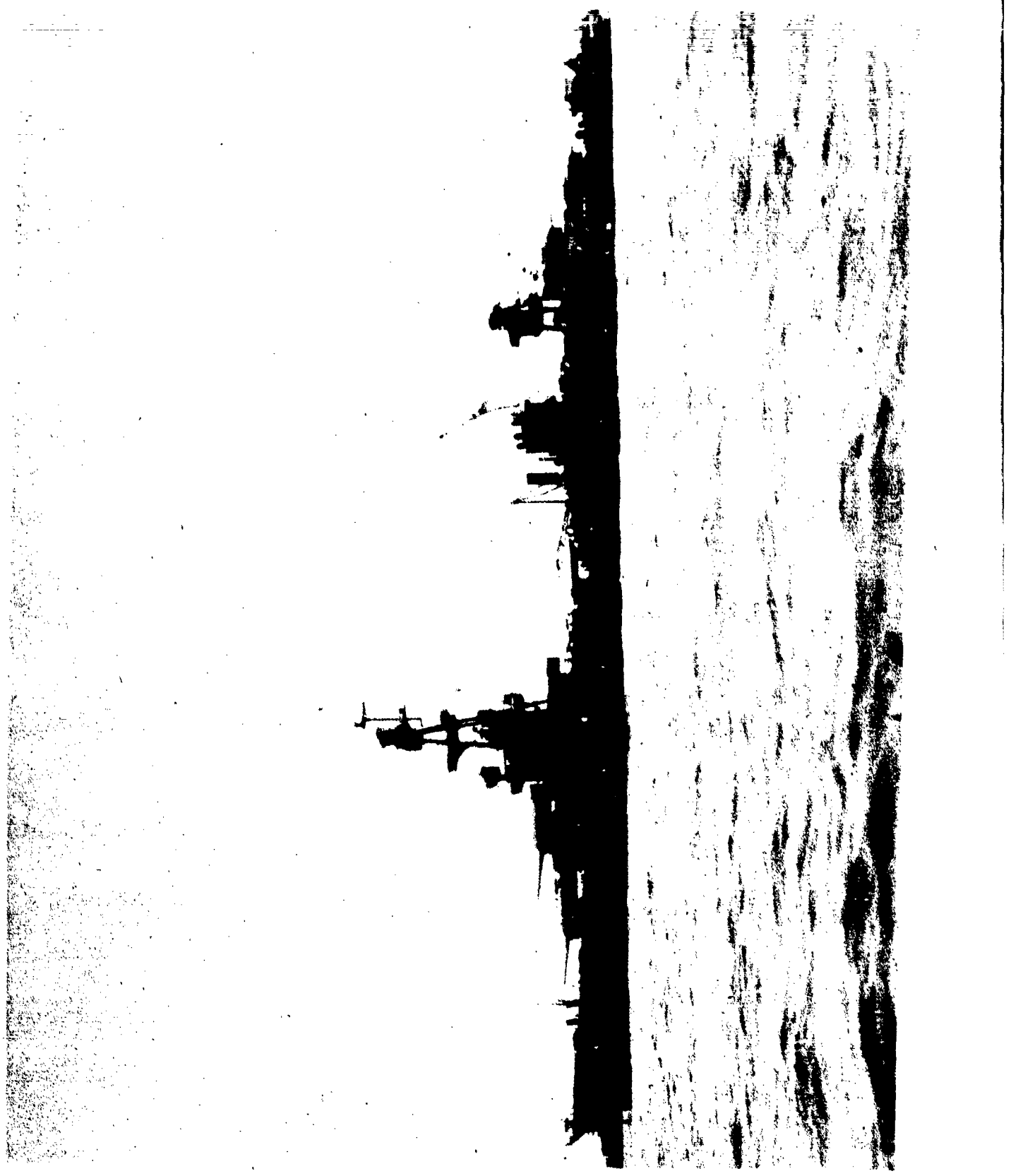
BB-CR-227-519-20. View from off port bow before Test B.



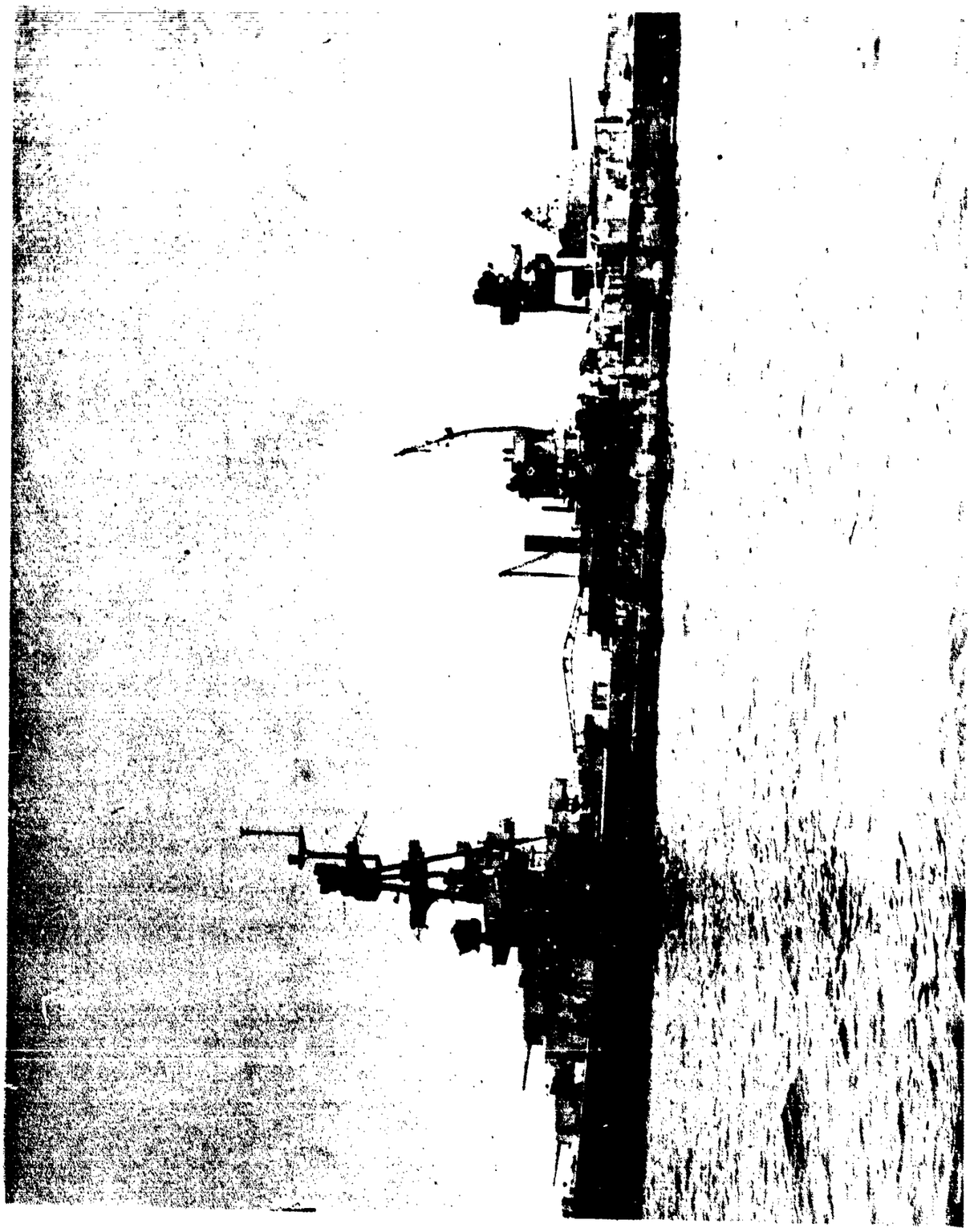
AB-CR-92-1788-3. General view, port bow.



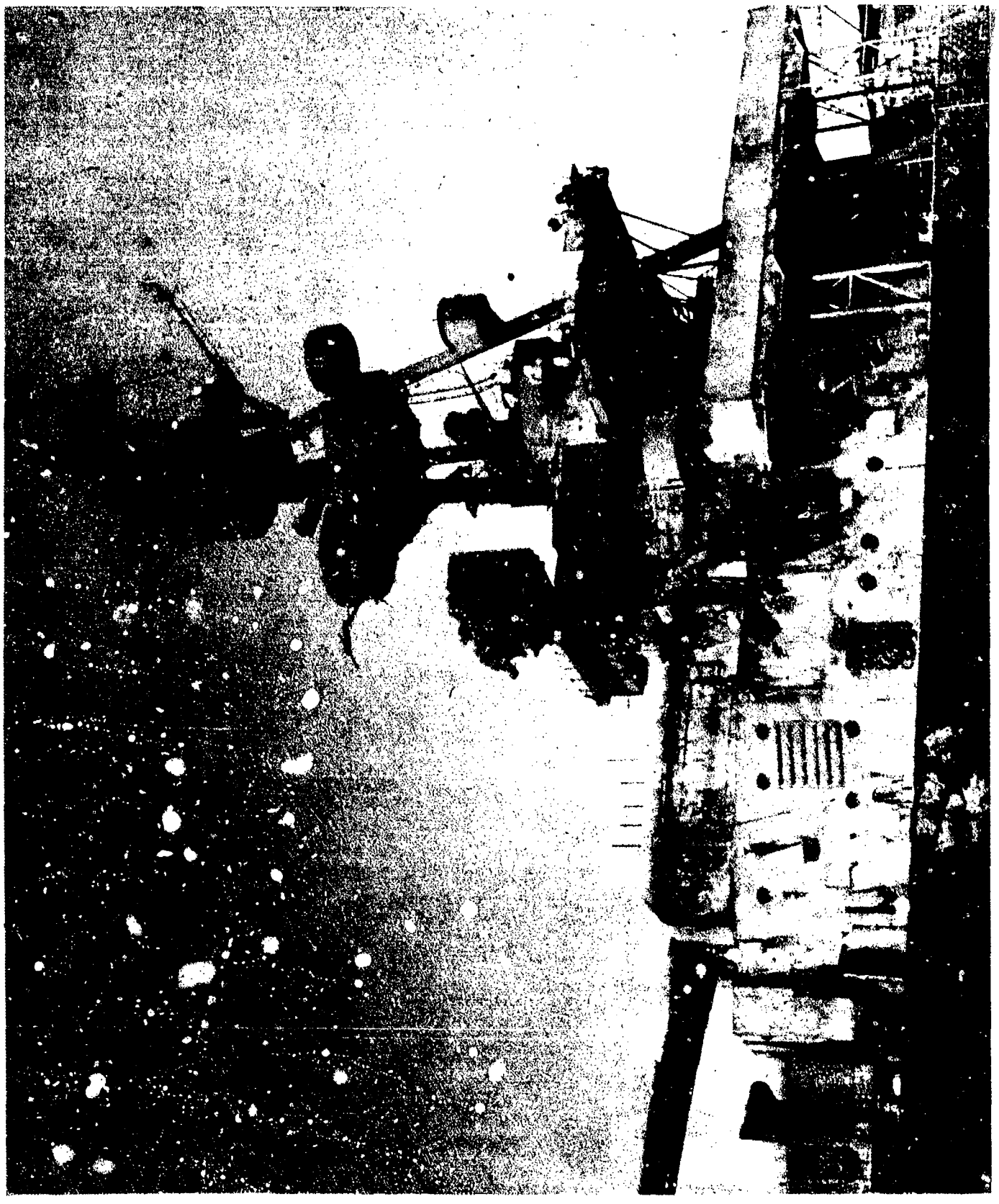
AB-CR-80-2093-7. General view, port side.



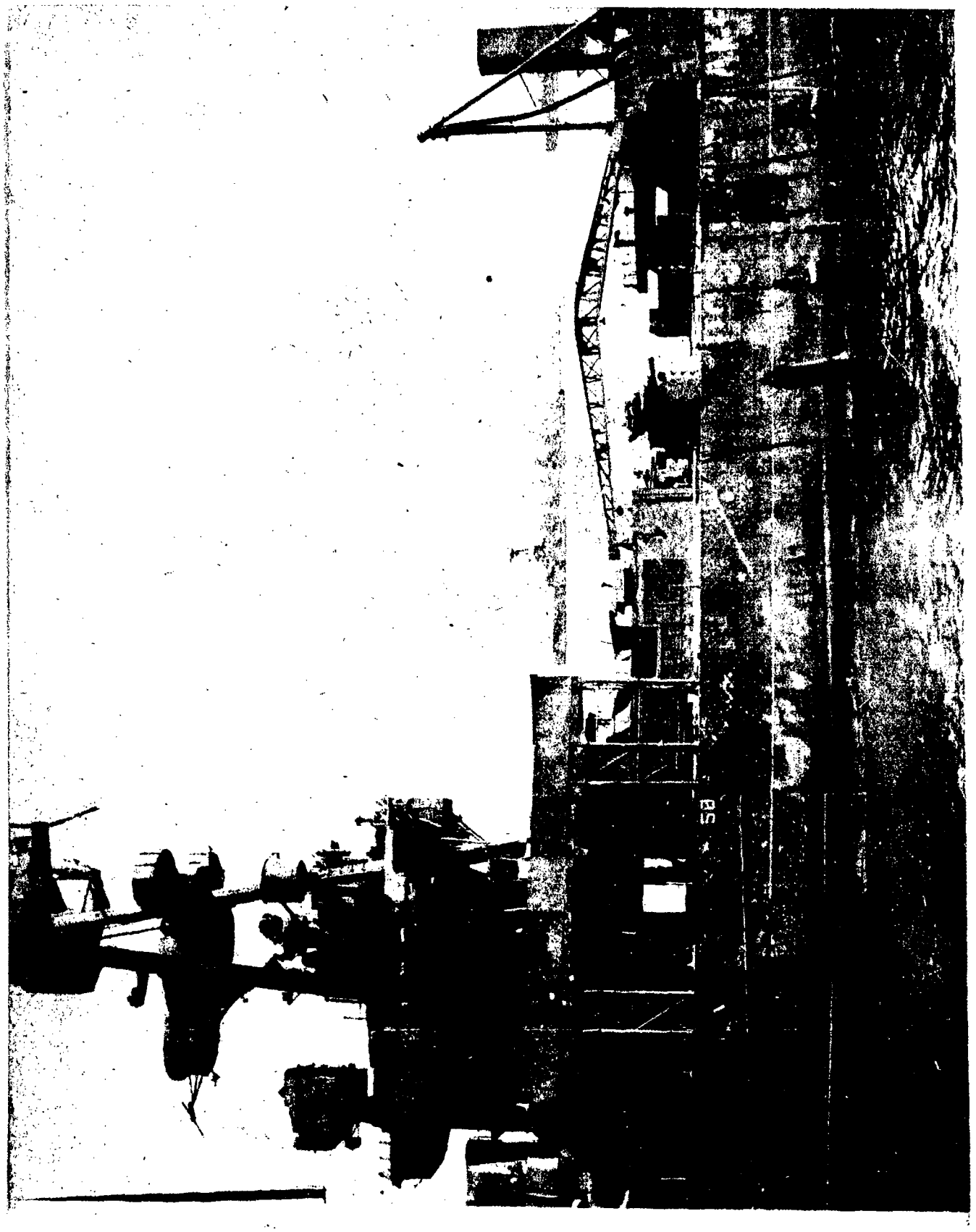
BB-CR-227-519-21. View from off port beam before Test B.



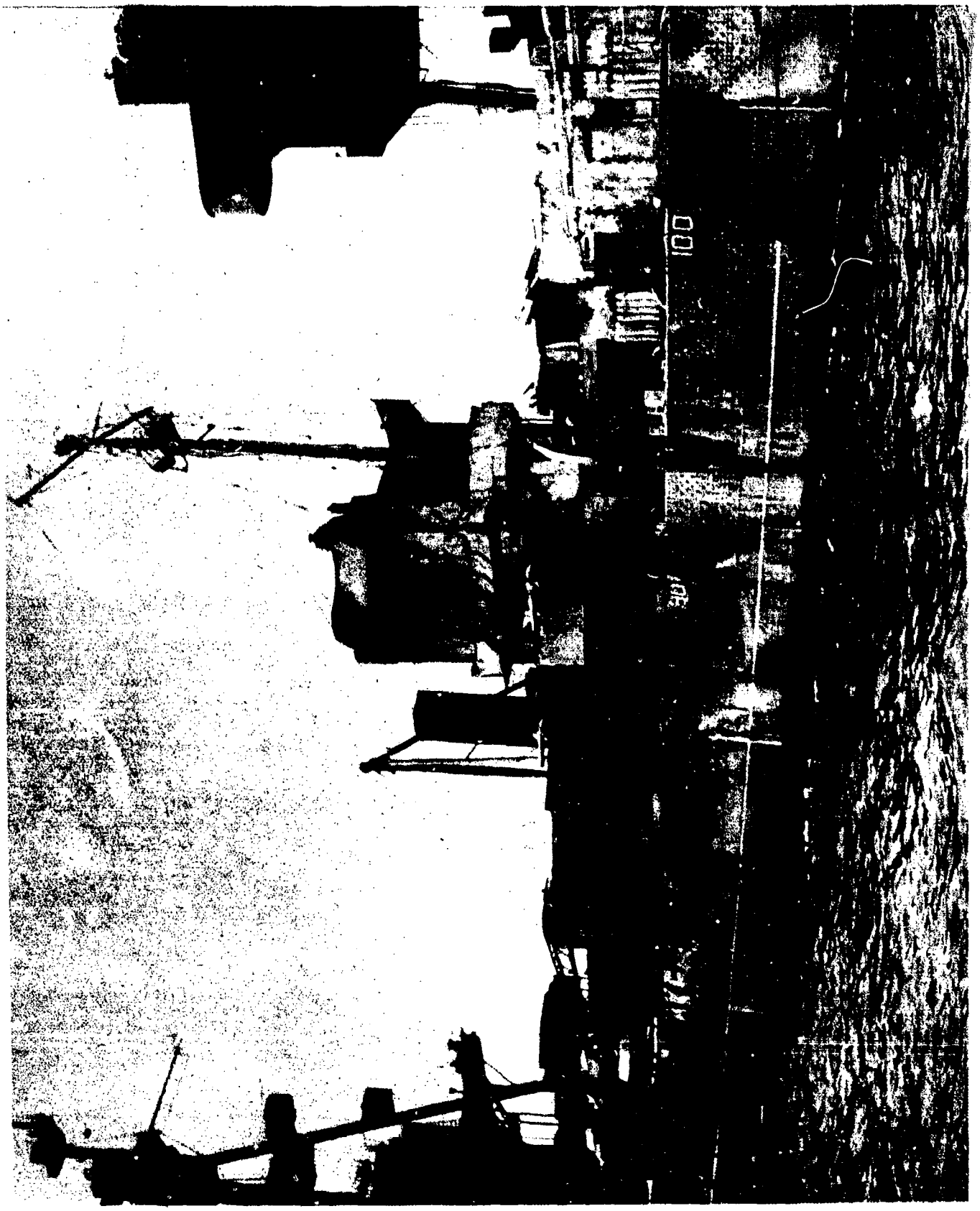
AB-CR-59-2998-10. General view, port side.



AB-CR-59-2997 General view, port side superstructure, frames 22 to 55.

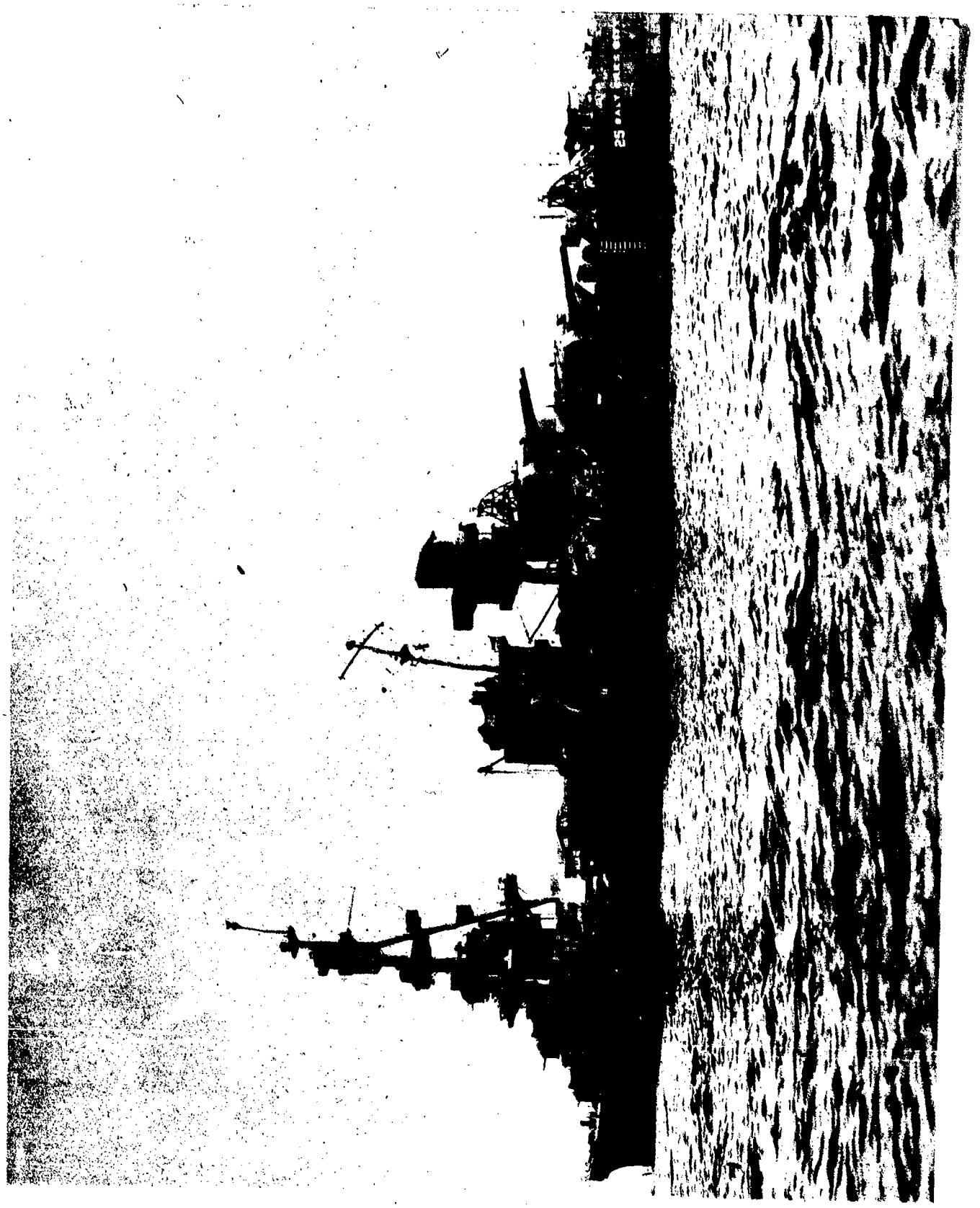


AB-CR-92-1788-4. General view, port side, frame 36 to 75.

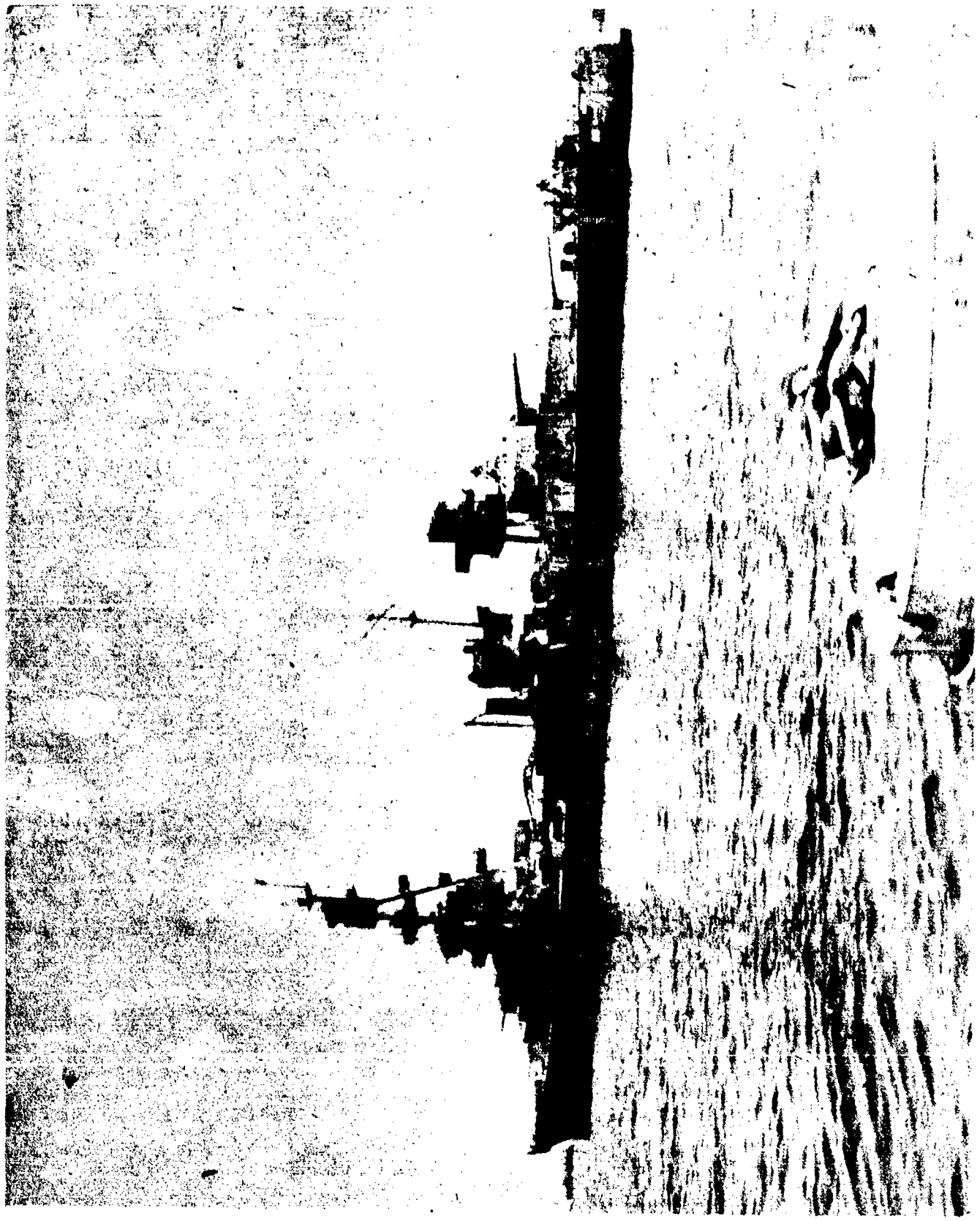


AB-CR-59-2997-9. General view, port side, frame 55 to 108.

AB-CR-59-2997-10. General view, port side, frames 92 to 122.

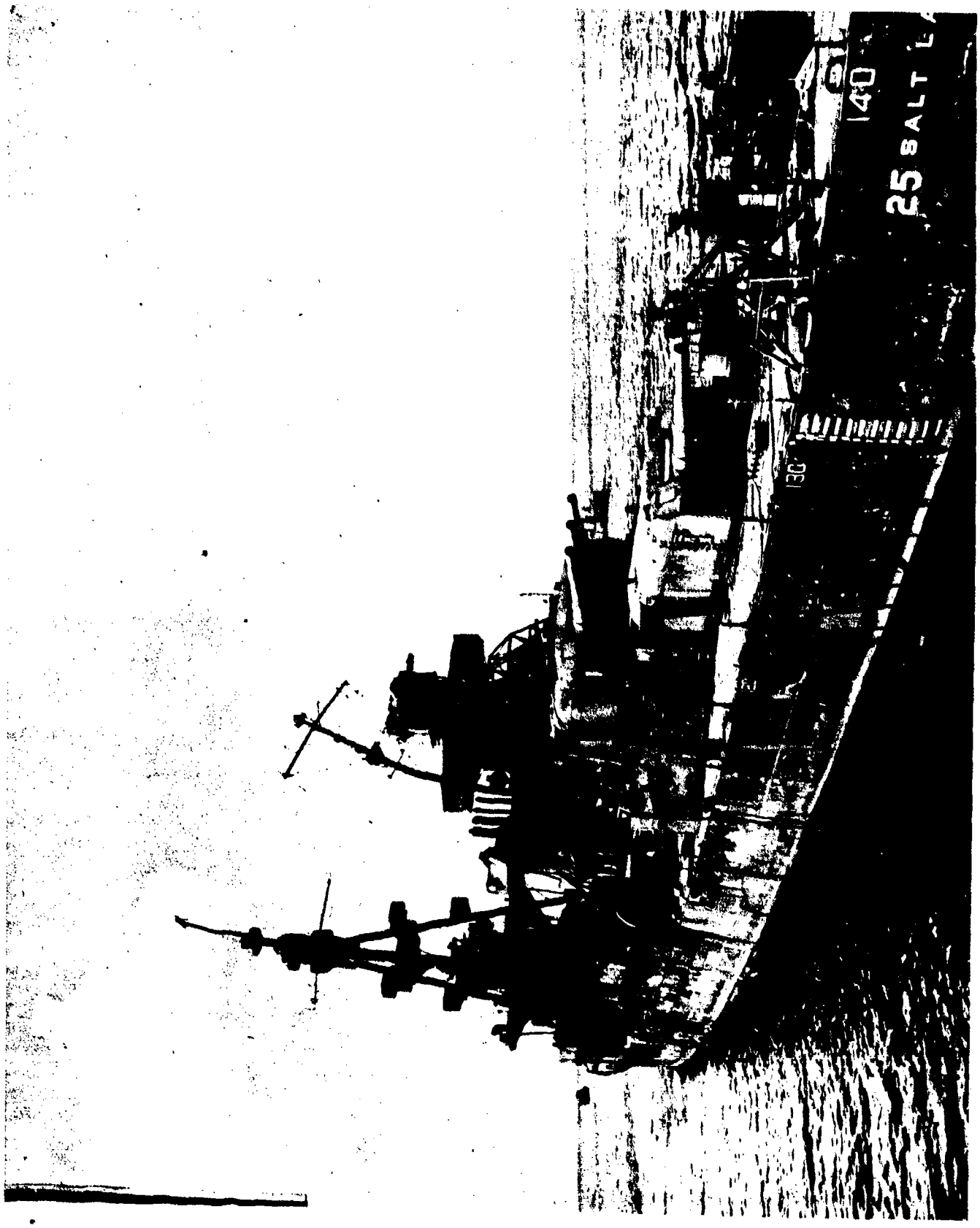


BB-CR-227-519-22. View from off port quarter before Test B.

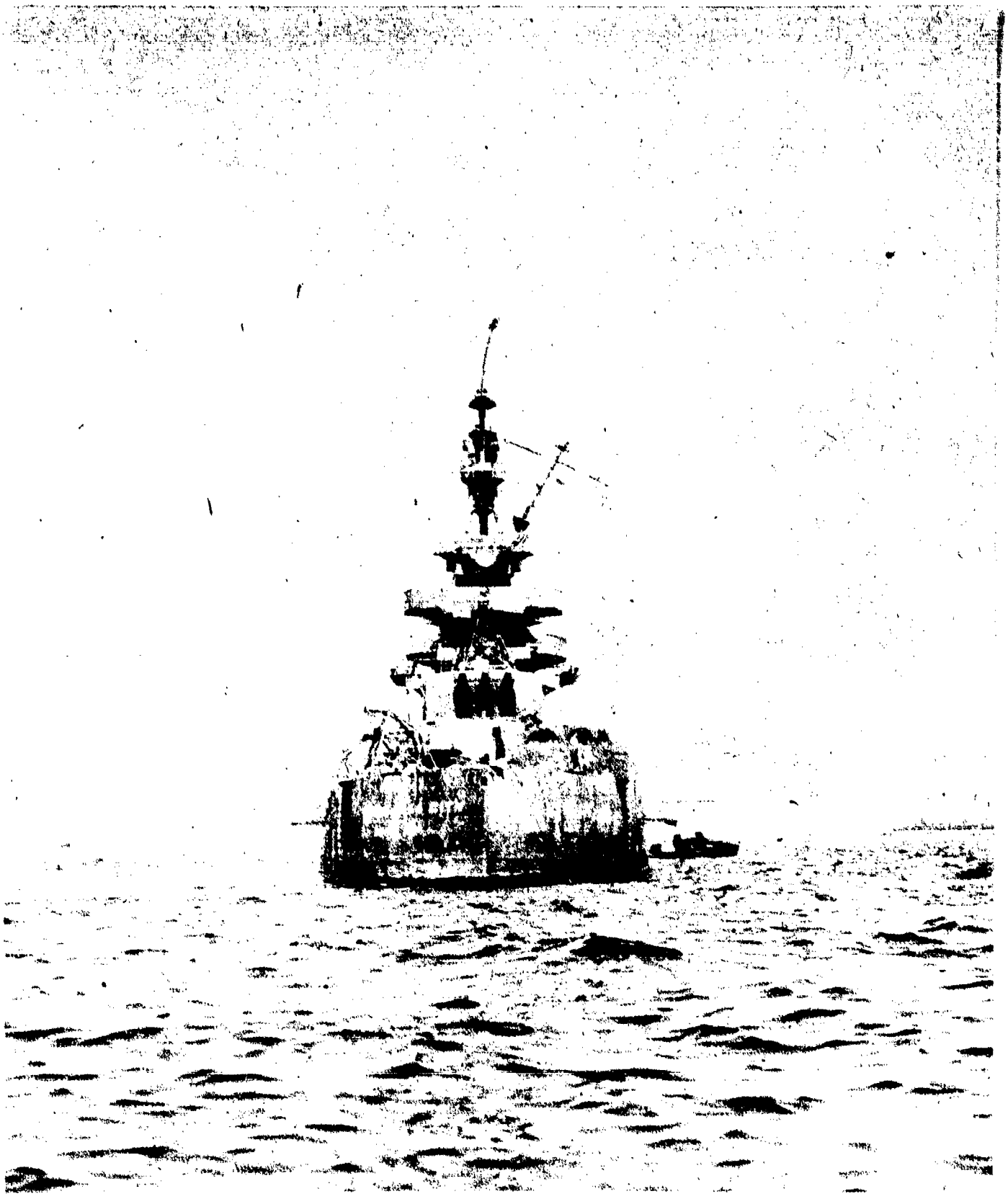


AB-CR-59-2998-11. General view, port side from the quarter.

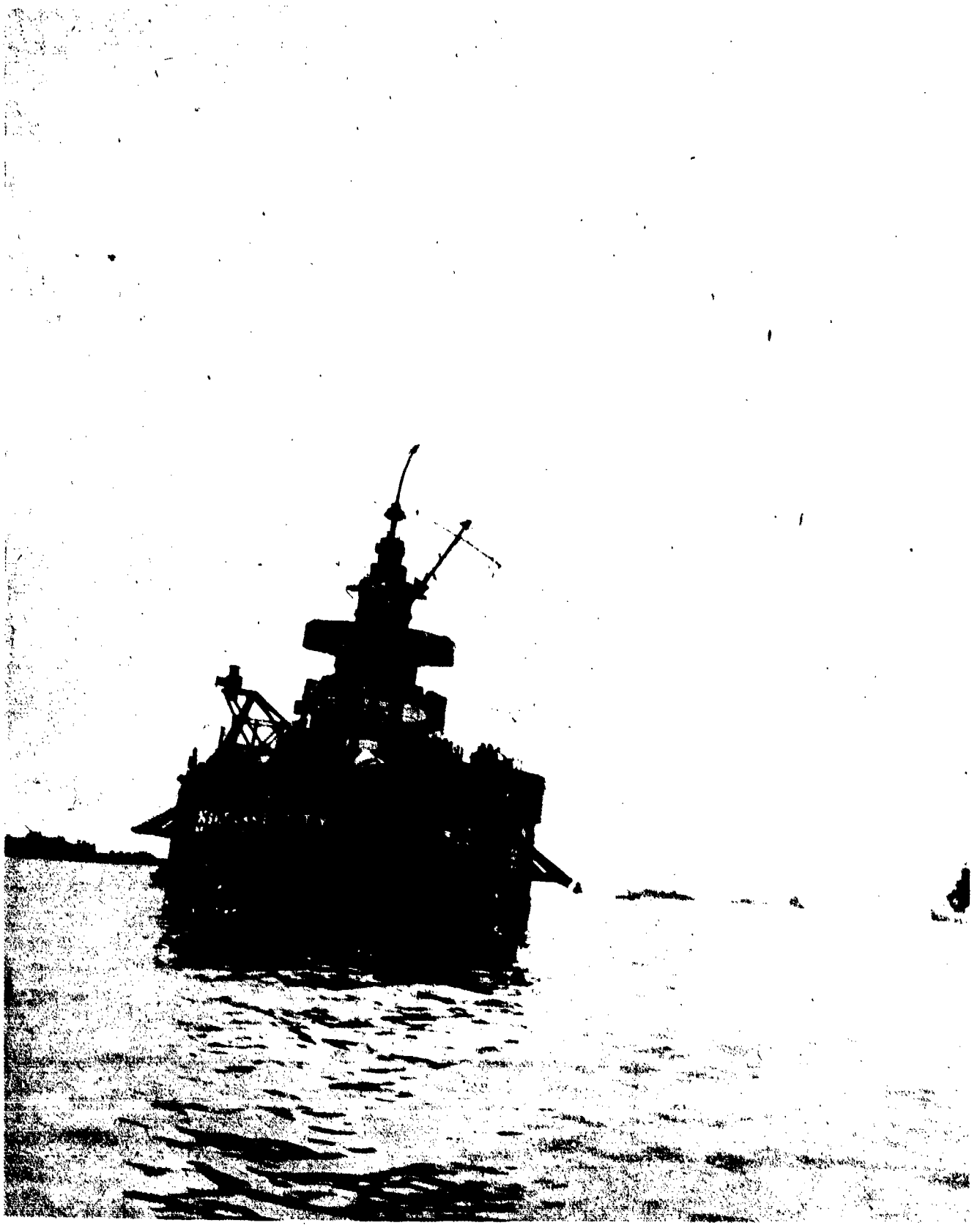
AB-CR-92-1788-5. General view, port side, frame 40 to stern.



AB-CR-80-2093-8. General view, port side, from the quarter.

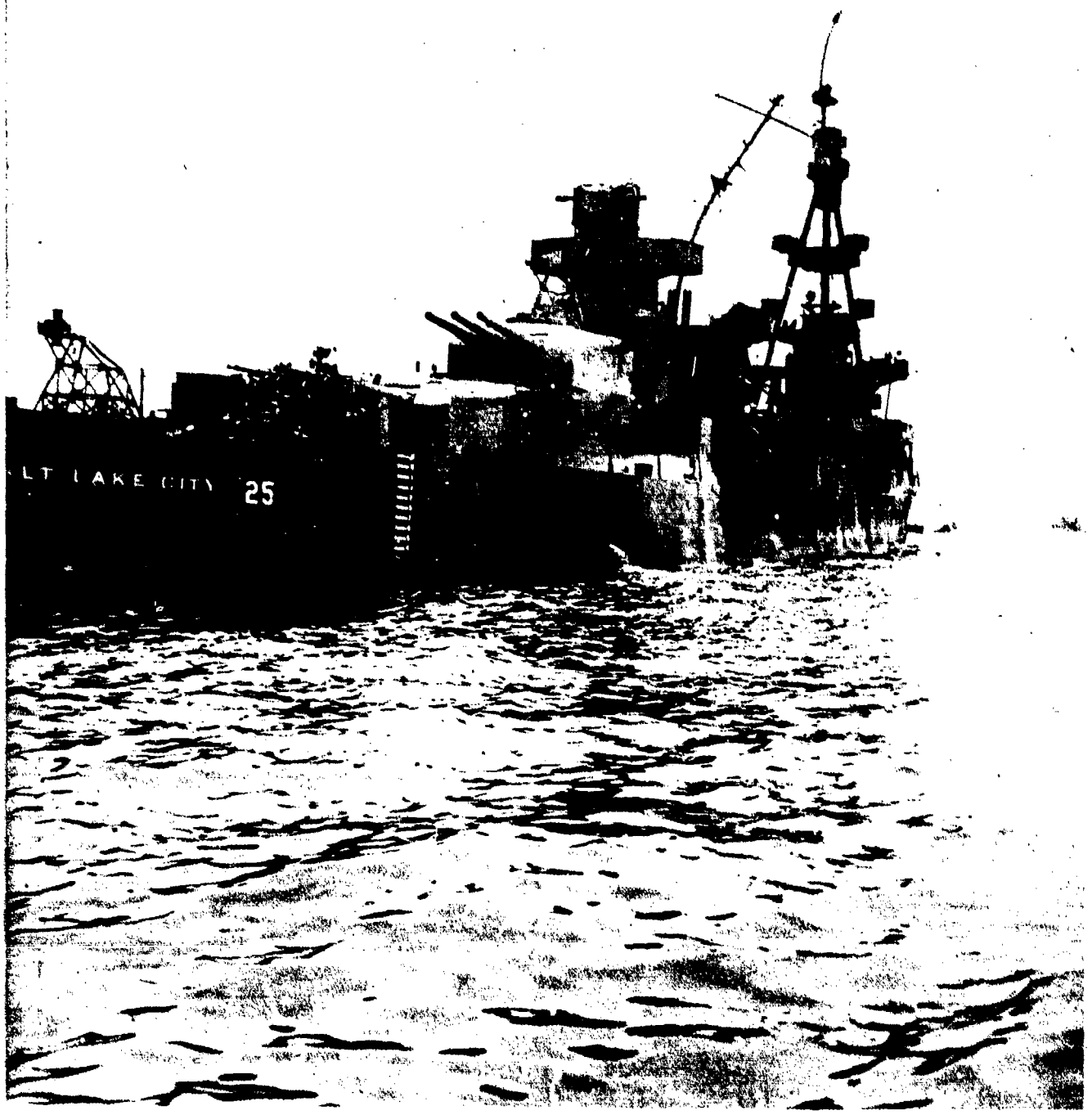


BB-CR-227-519-23. View from astern before Test B.

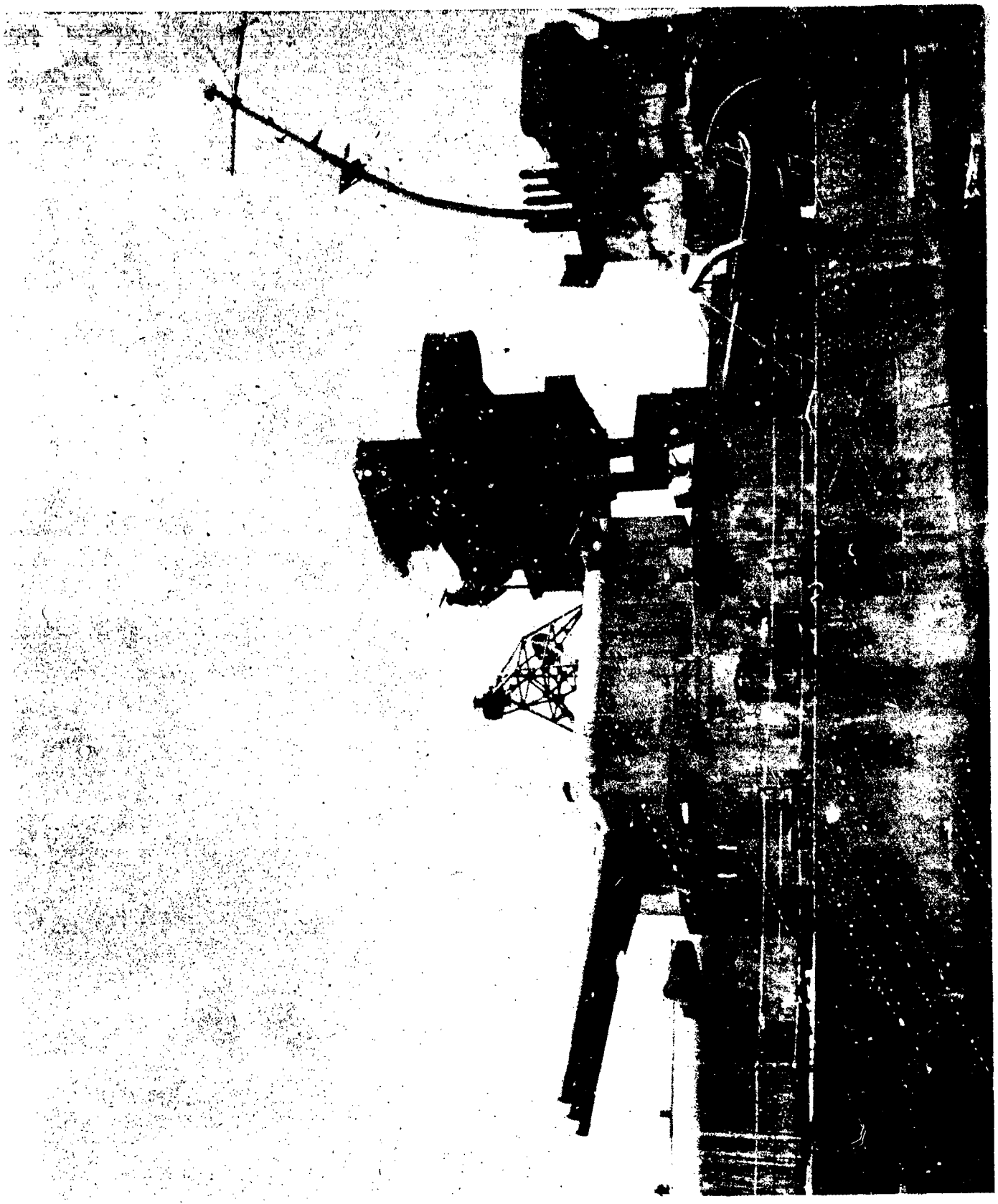


AB-CR-79-2967-3. General view, stern.

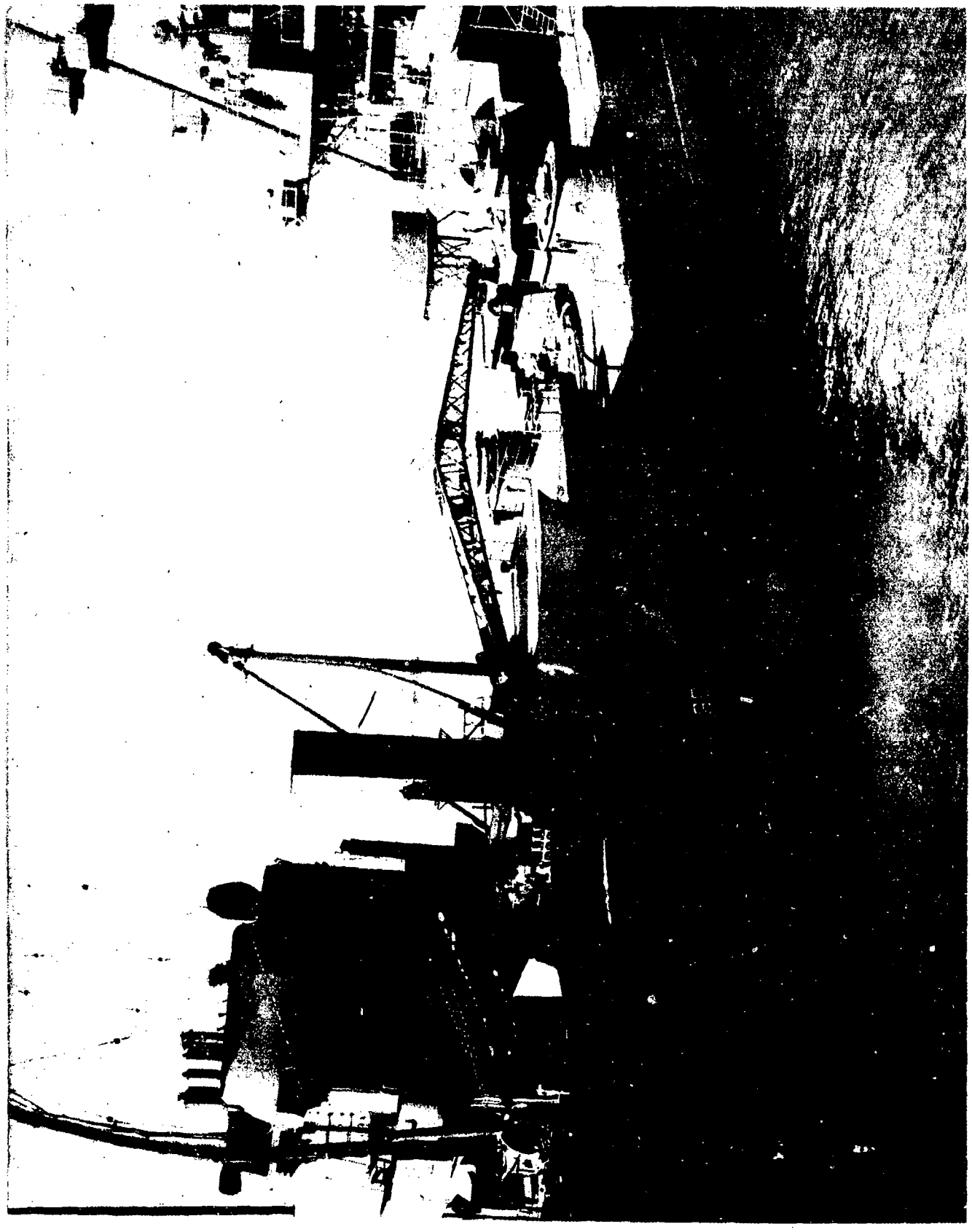
BB-CR-227-519-24. View from off starboard quarter before Test B.



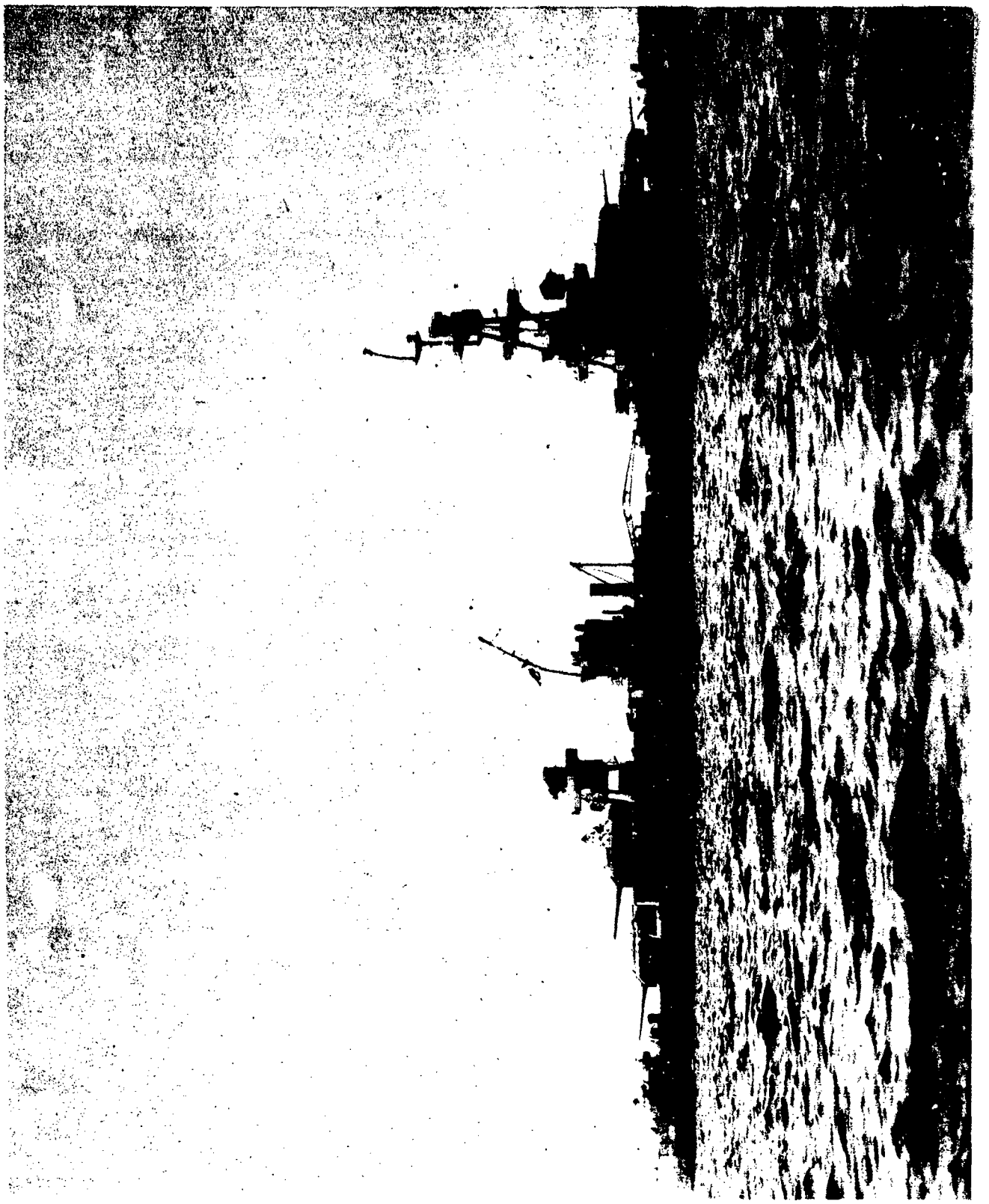
AB-CR-79-2967-2. General view, starboard side from quarter.



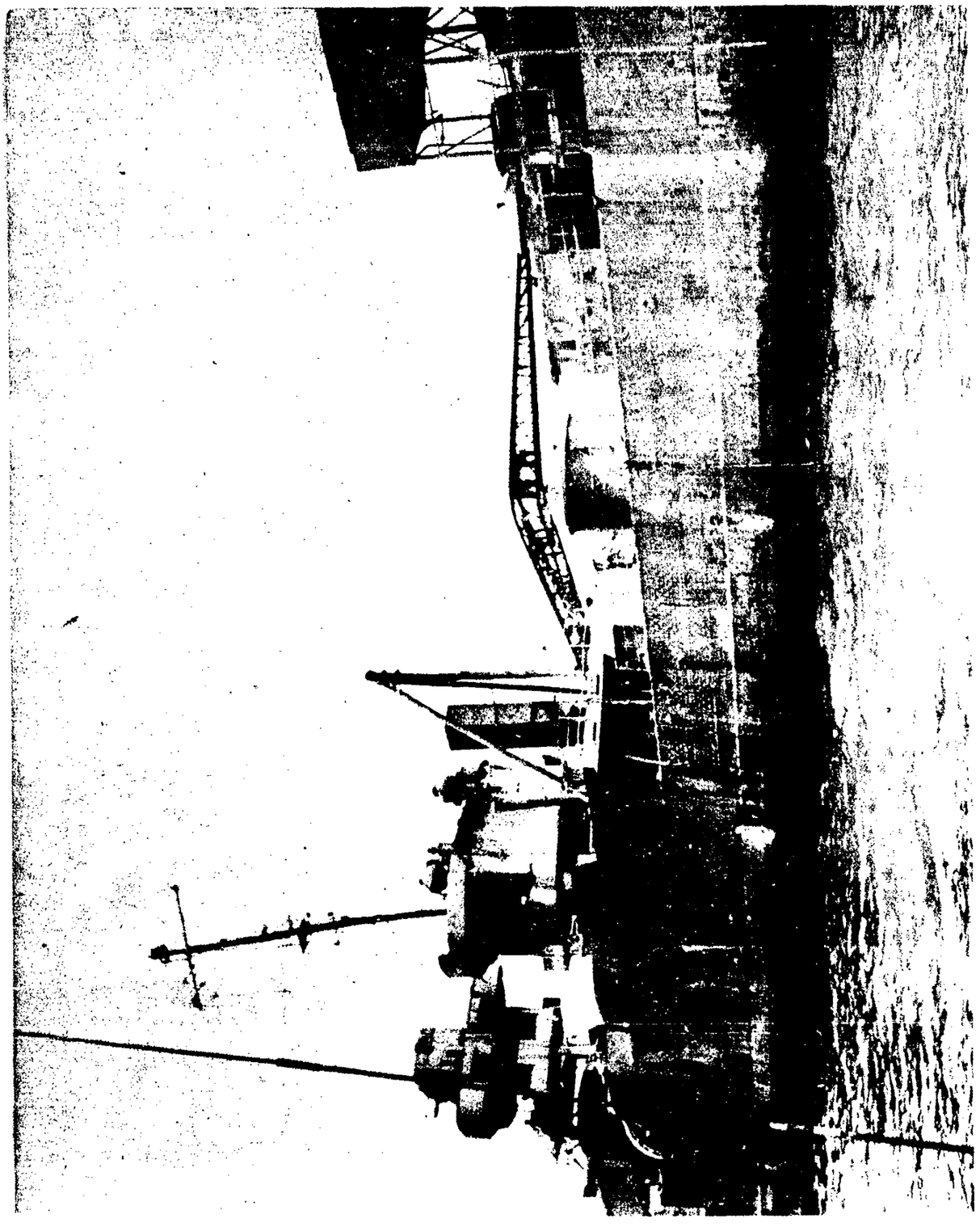
AB-CR-59-2997-6. General view, starboard side, frames 76 to 121.



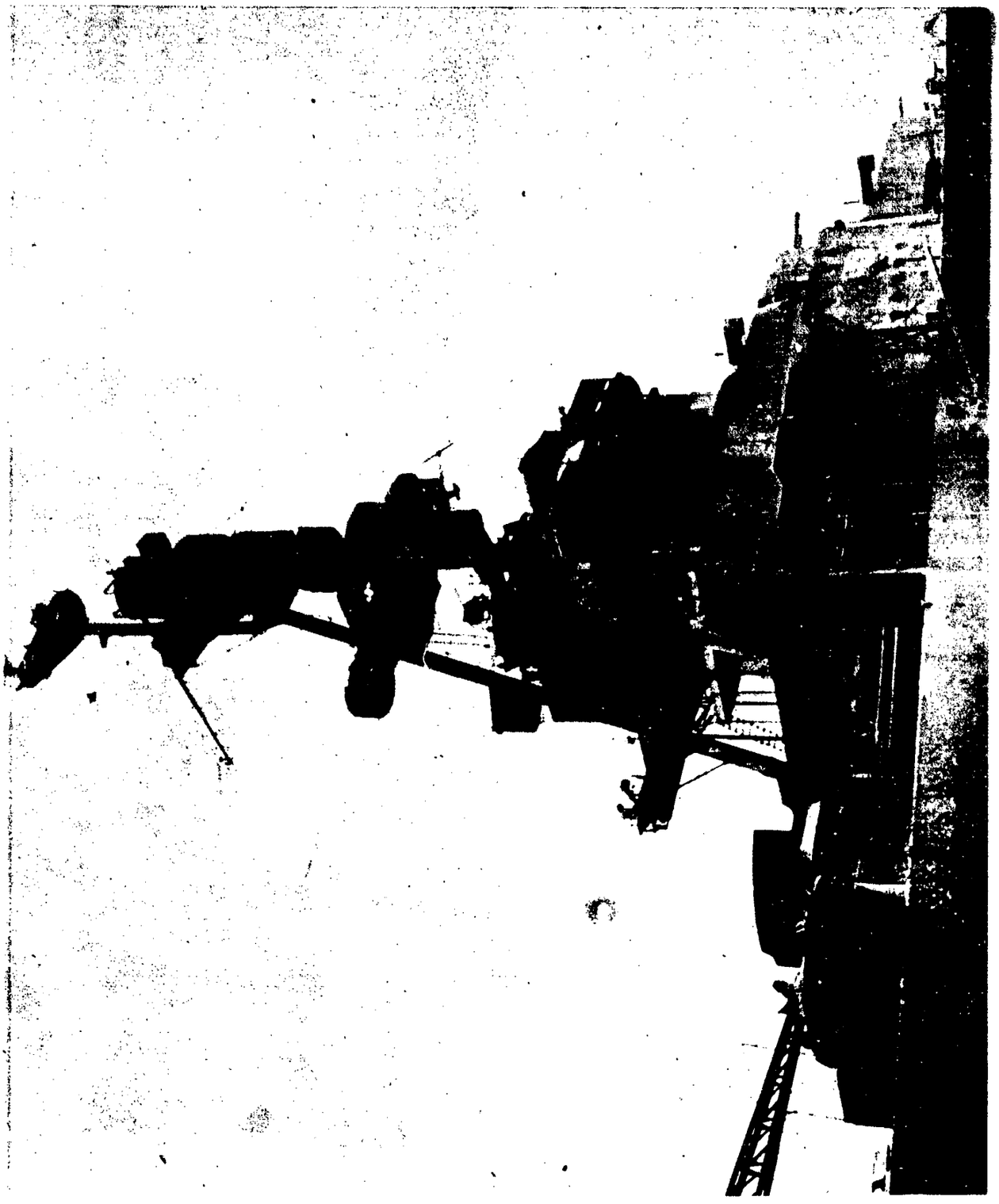
AB-CR-92-1788-7. General view, starboard side, frames 50 to 90.



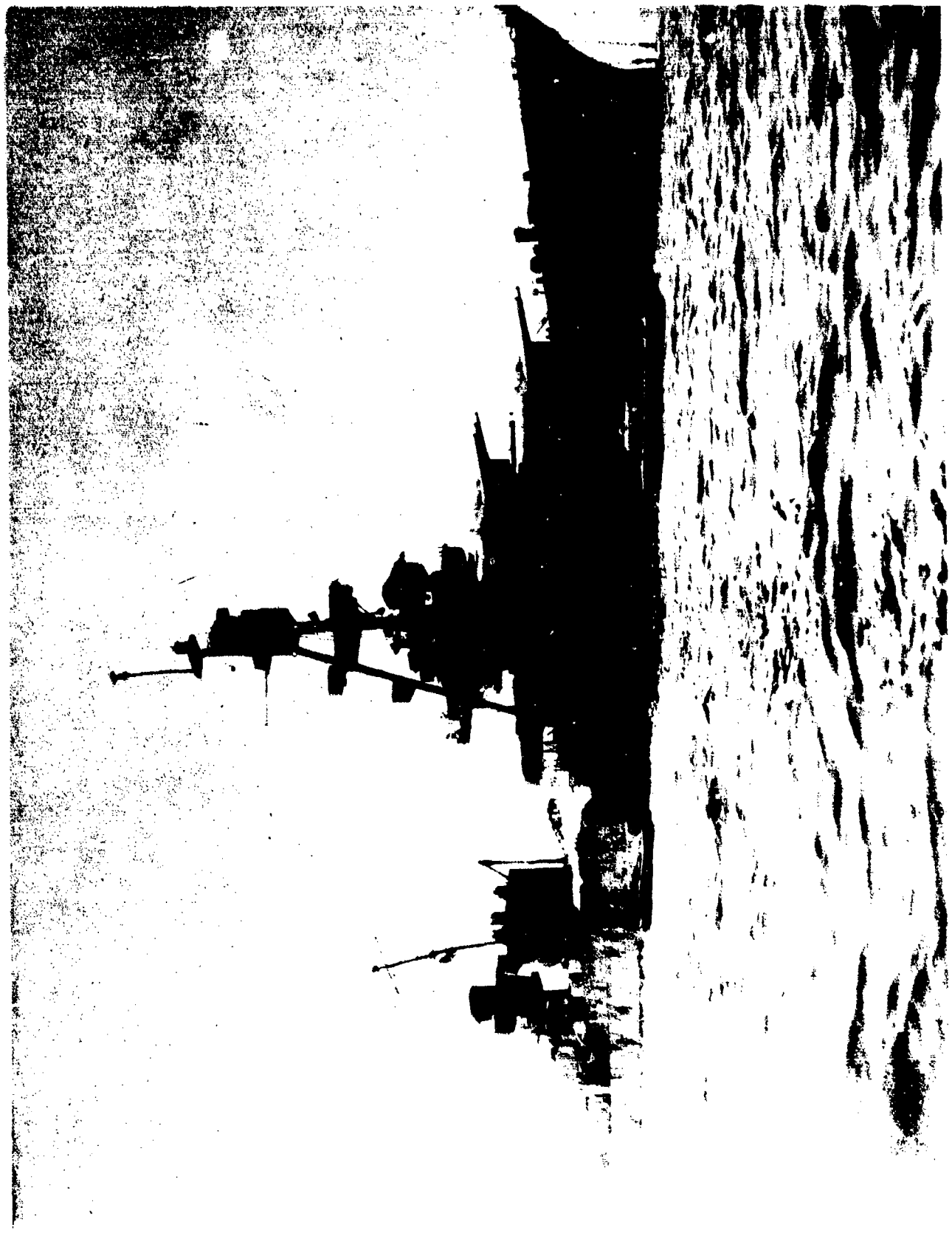
BB-CR-227-519-17. View from off starboard beam before Test B.



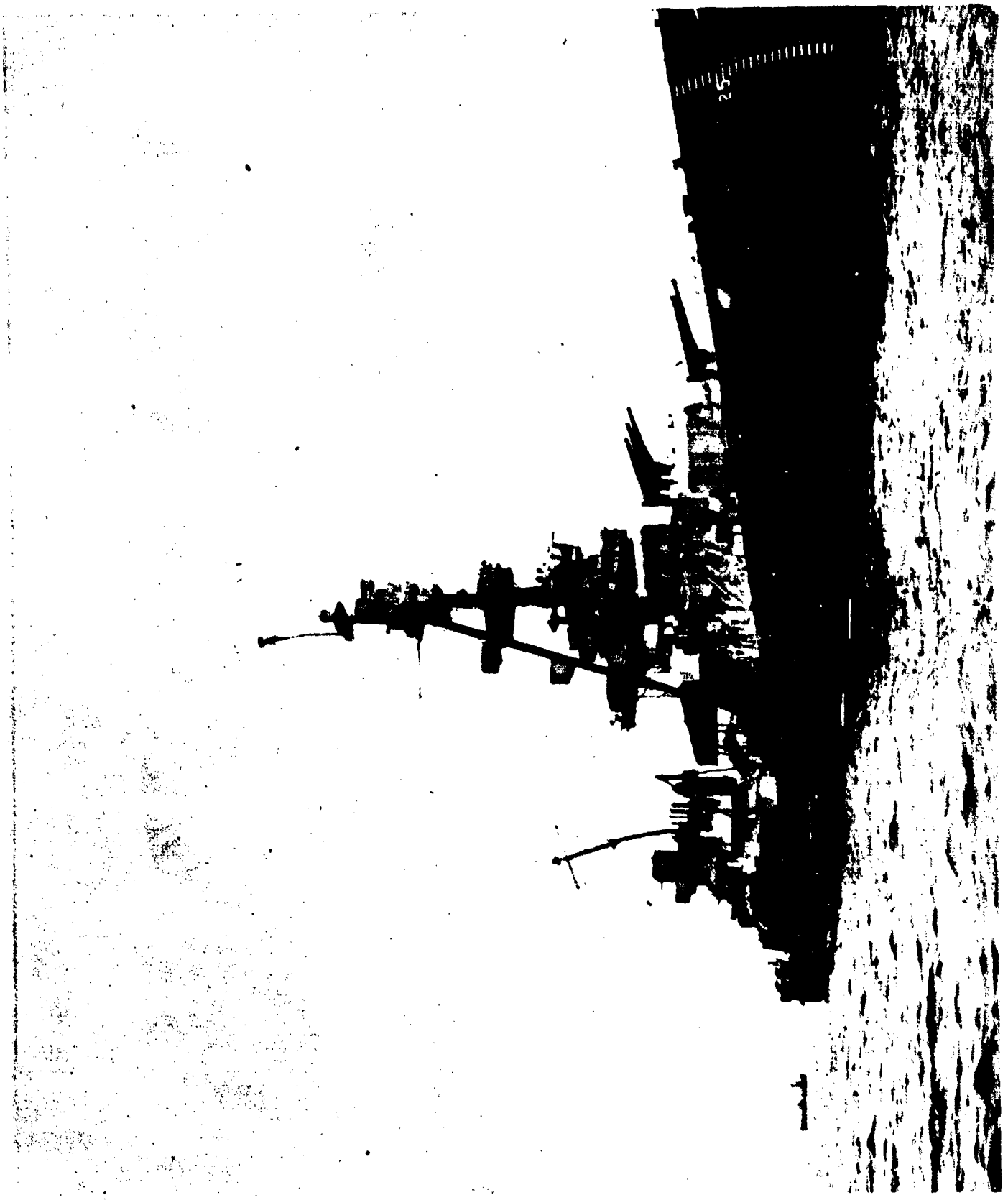
AB-CR-59-2997-4. General view, to starboard, frames 50 to 100.



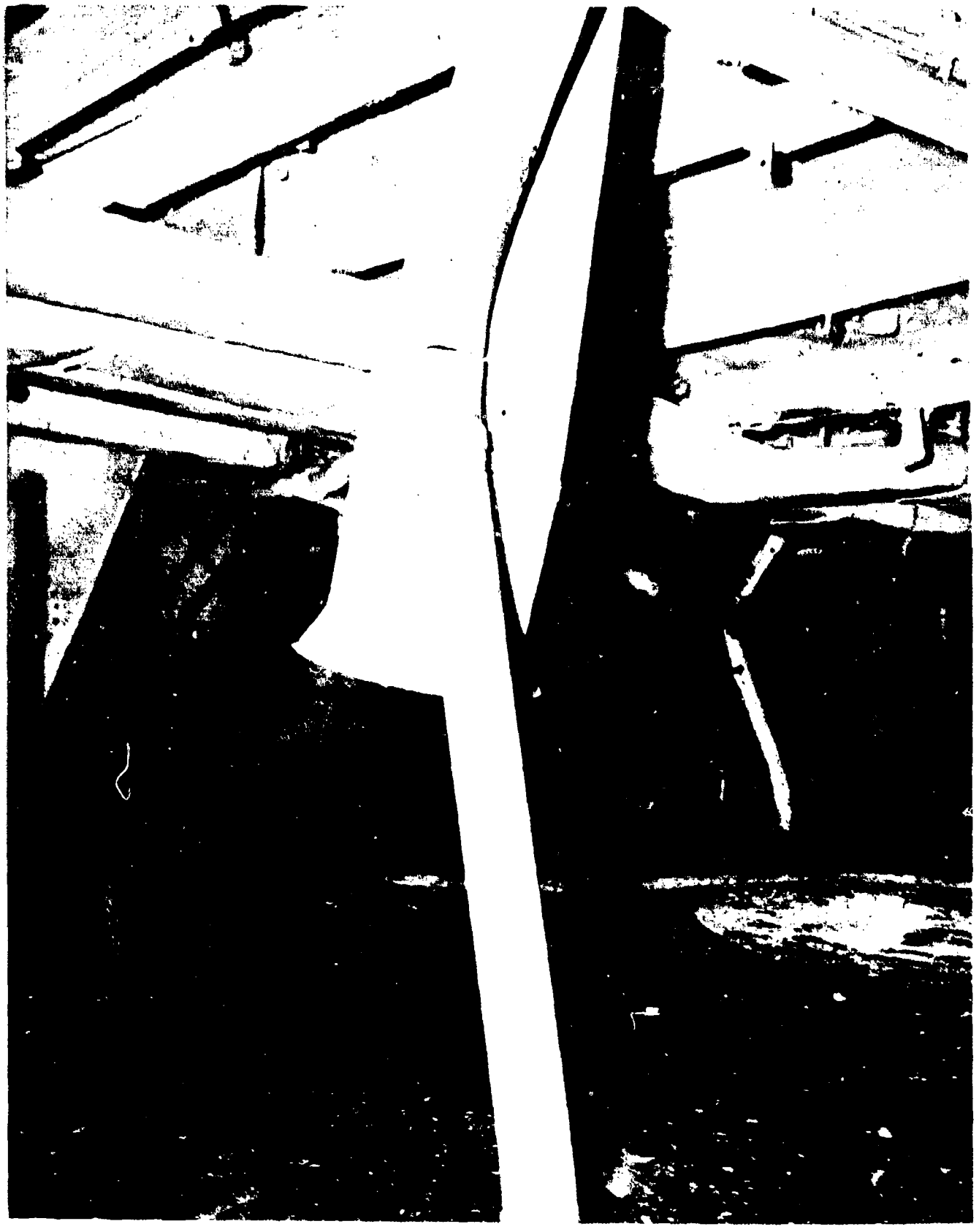
AB-CR-59-2997-5. General view, starboard side, bow to frame 70.



BB-CR-227-519-18. View from off starboard bow before Test B.

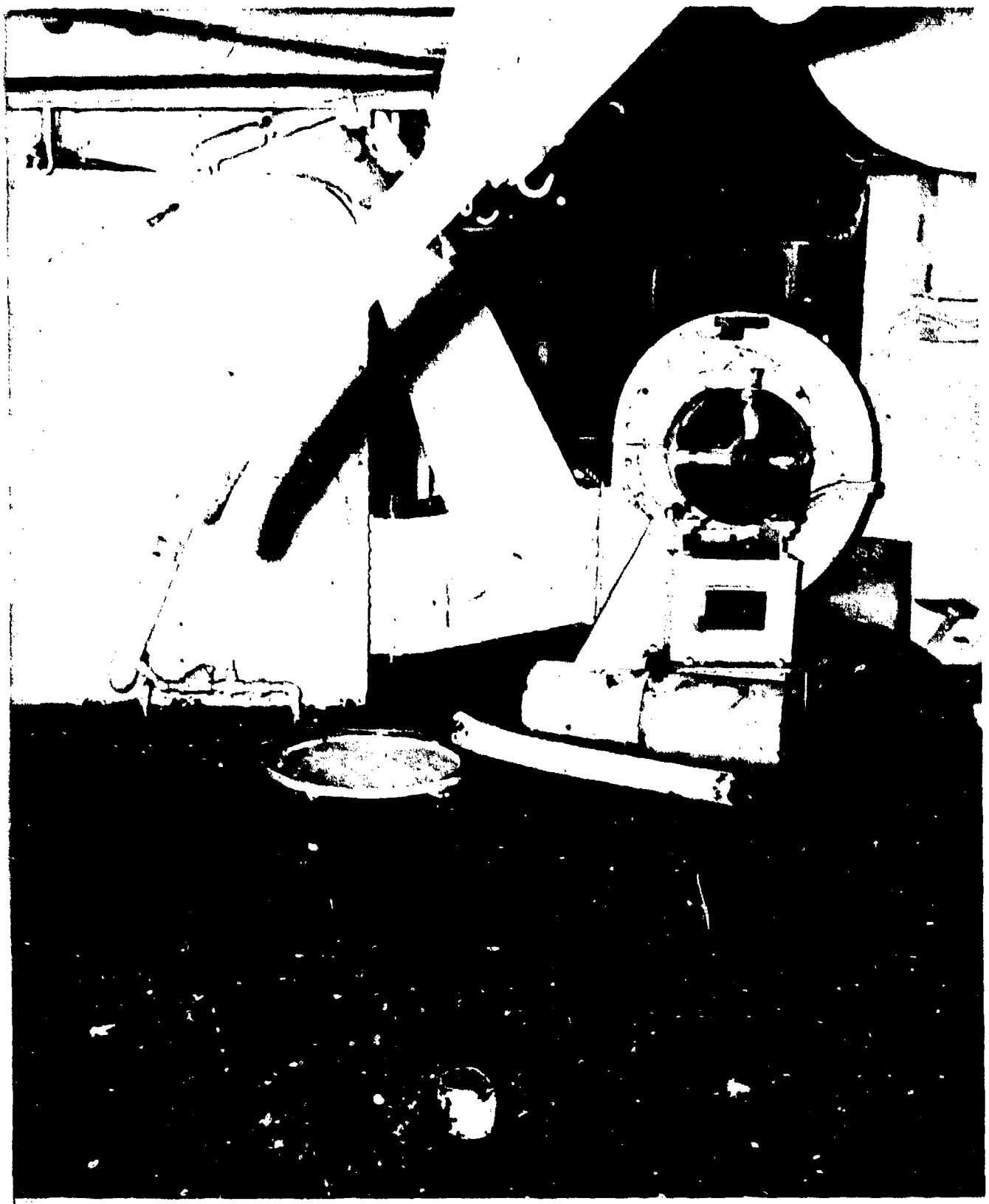


AB-CR-59-2997-3. General view, starboard side, from the bow.

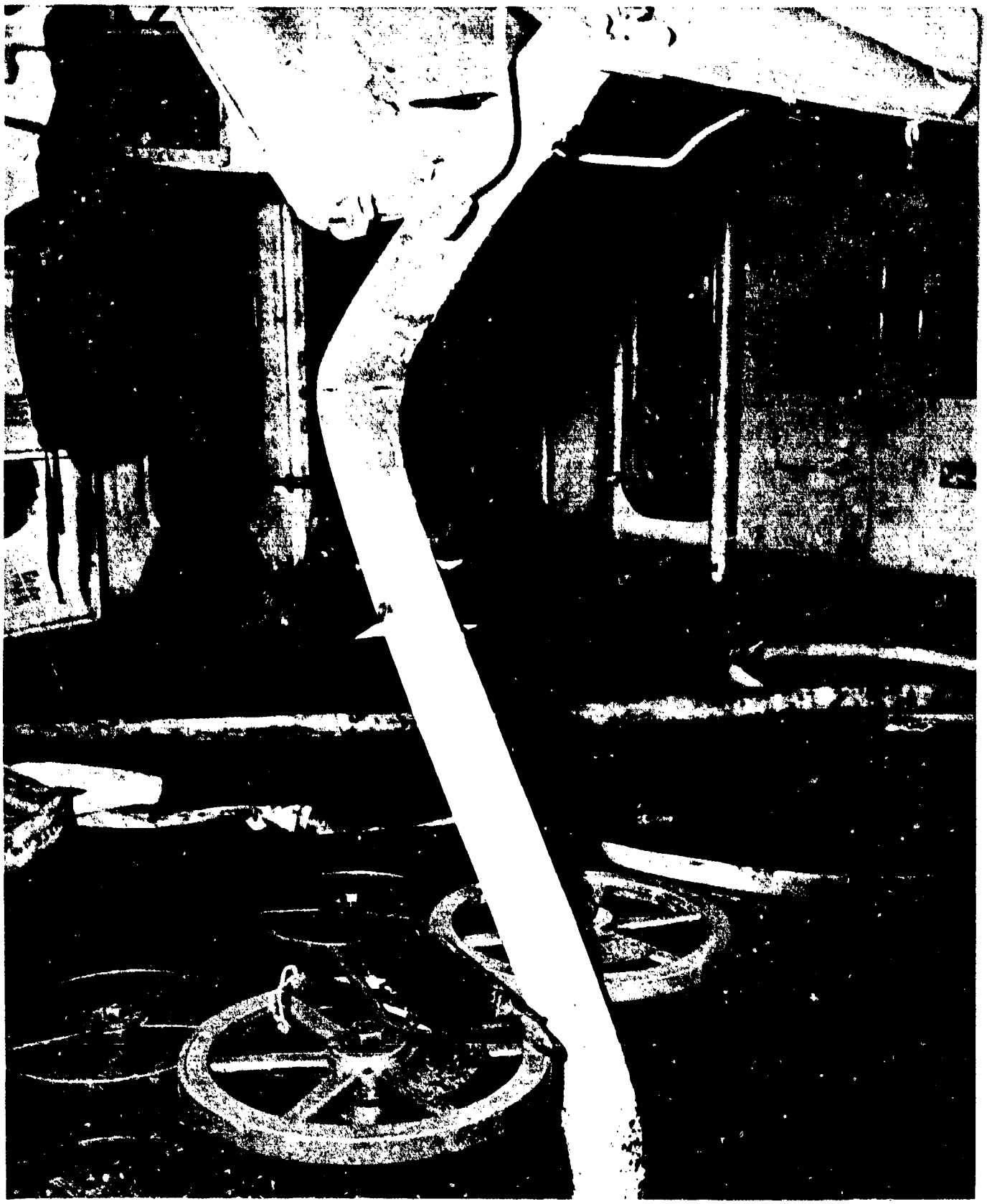


AB-CR-65-1718-8. C-201L. Fracture of port (in foreground) and centerline stanchions under main deck transverse girder at frame 68. Compare with 2098-2 and 2102-11 showing condition after Test A.

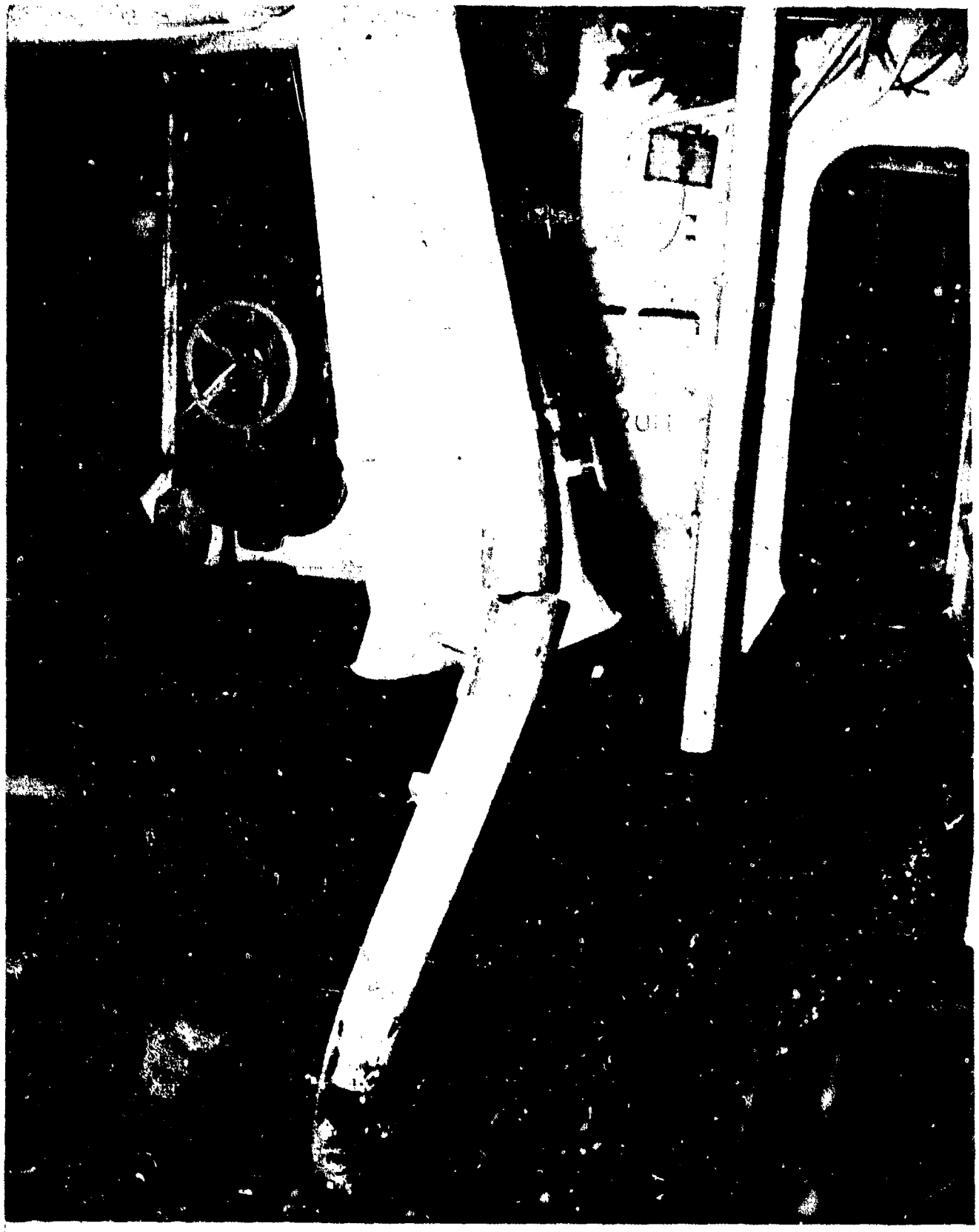
AB-CR-65-1718-9. C-201L. Fracture of port (in foreground) and centerline stanchions under main deck transverse girder at frame 68. Compare with 2098-2 and 2102-11 showing condition after Test A.



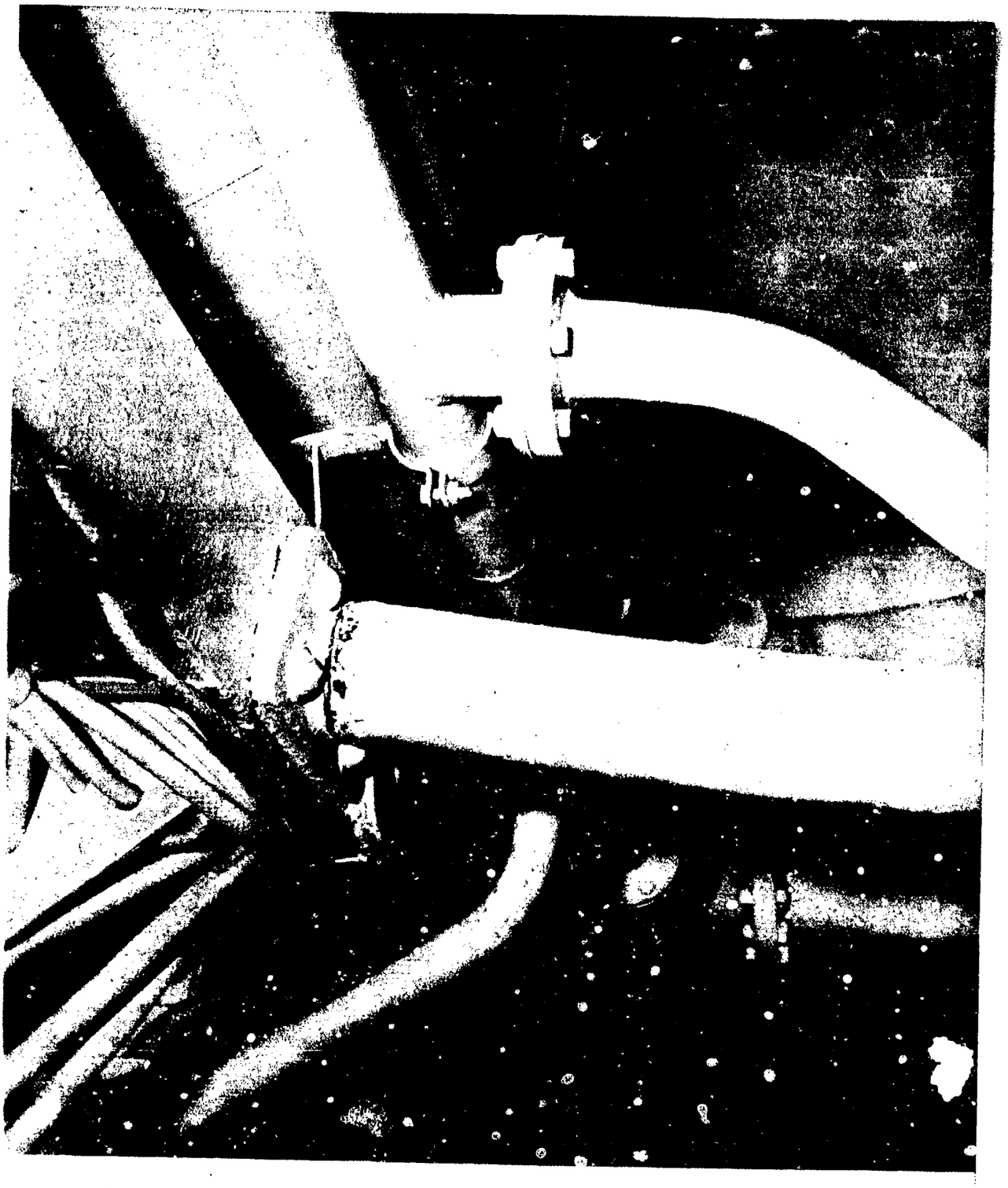
AB-CR-65-1718-10. C-201L. Fracture of centerline stanchion under main deck transverse girder at frame 68. Compare with 1894-8, 2102-10, and 2102-12 showing condition after Test A.



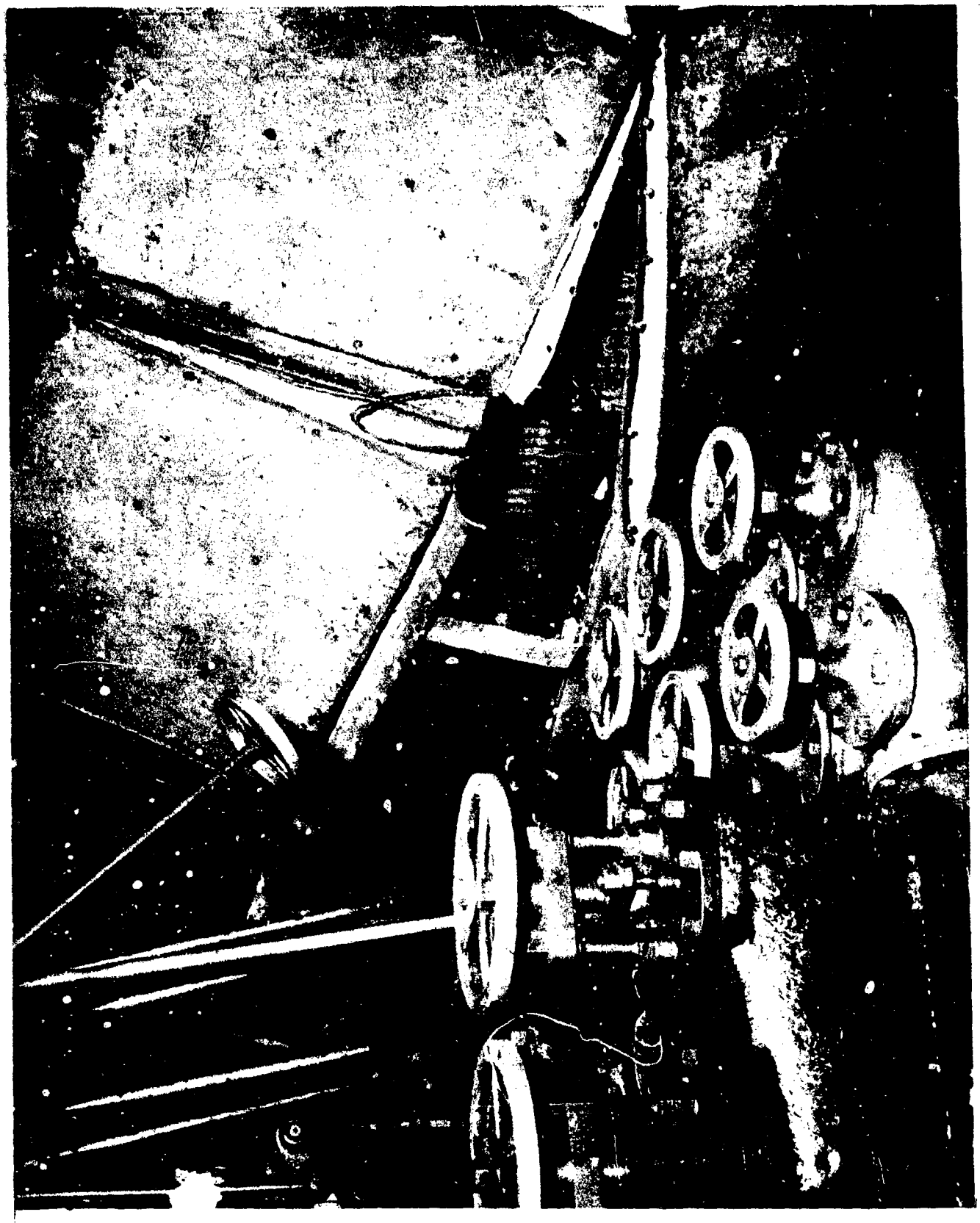
AB-CR-65-1718-11. C-201L. Fracture of centerline stanchion under main deck transverse girder at frame 65. Compare with 2102-3, 2102-4, 2102-5, and 1894-7. Showing condition after Test A.



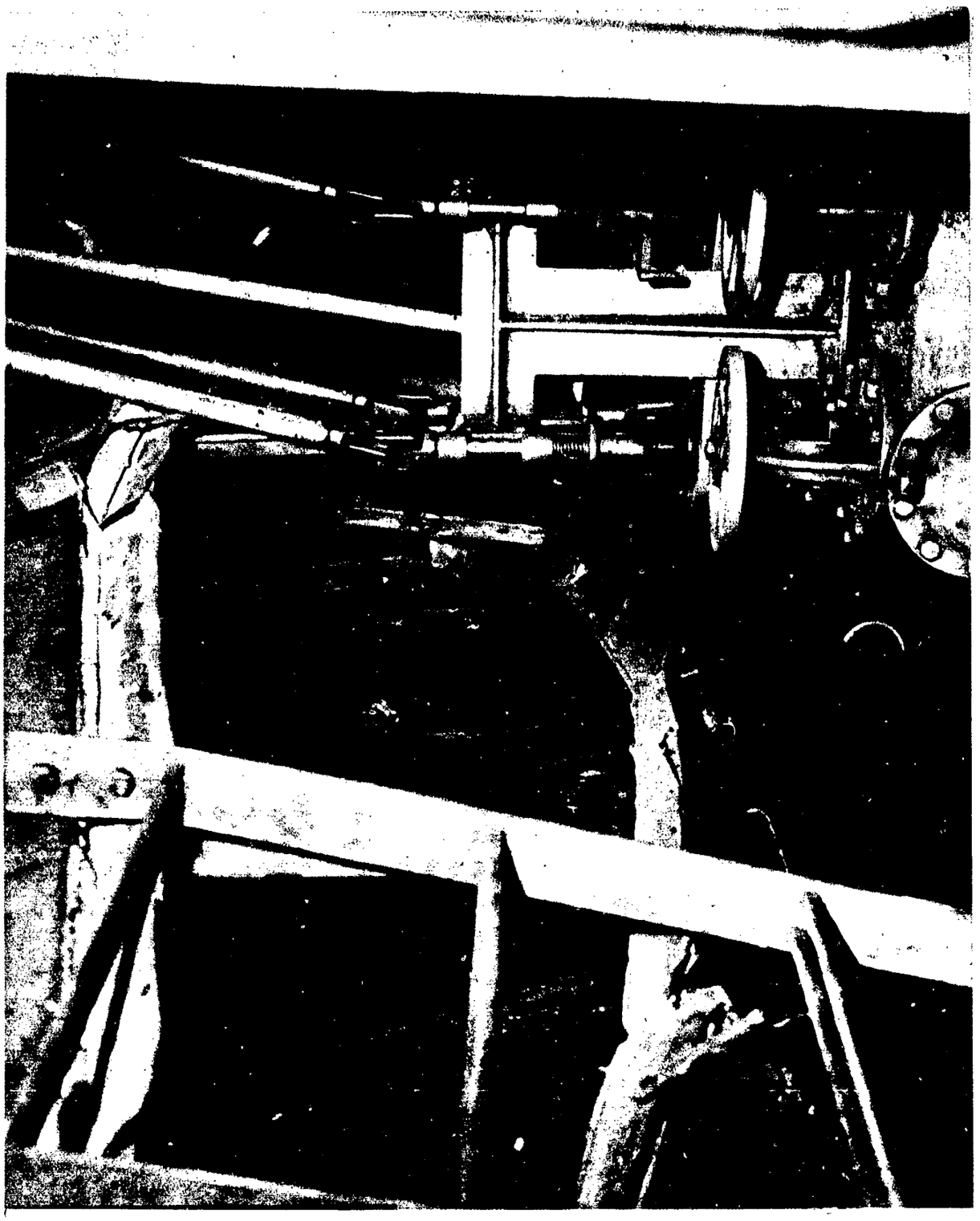
AB-CR-65-1718-12. C-201L. Fracture of stanchion supporting main deck transverse girder at frame 65, 16 feet off centerline to starboard. Compare with 2102-7 showing condition after Test A.



AB-CR-60-1710-1. Centerline stanchion at frame 97, second deck compressed and buckled during Test A, snapped during Test B.



AB-CR-2[illegible]4-4060-2. No. 3 boiler casing.

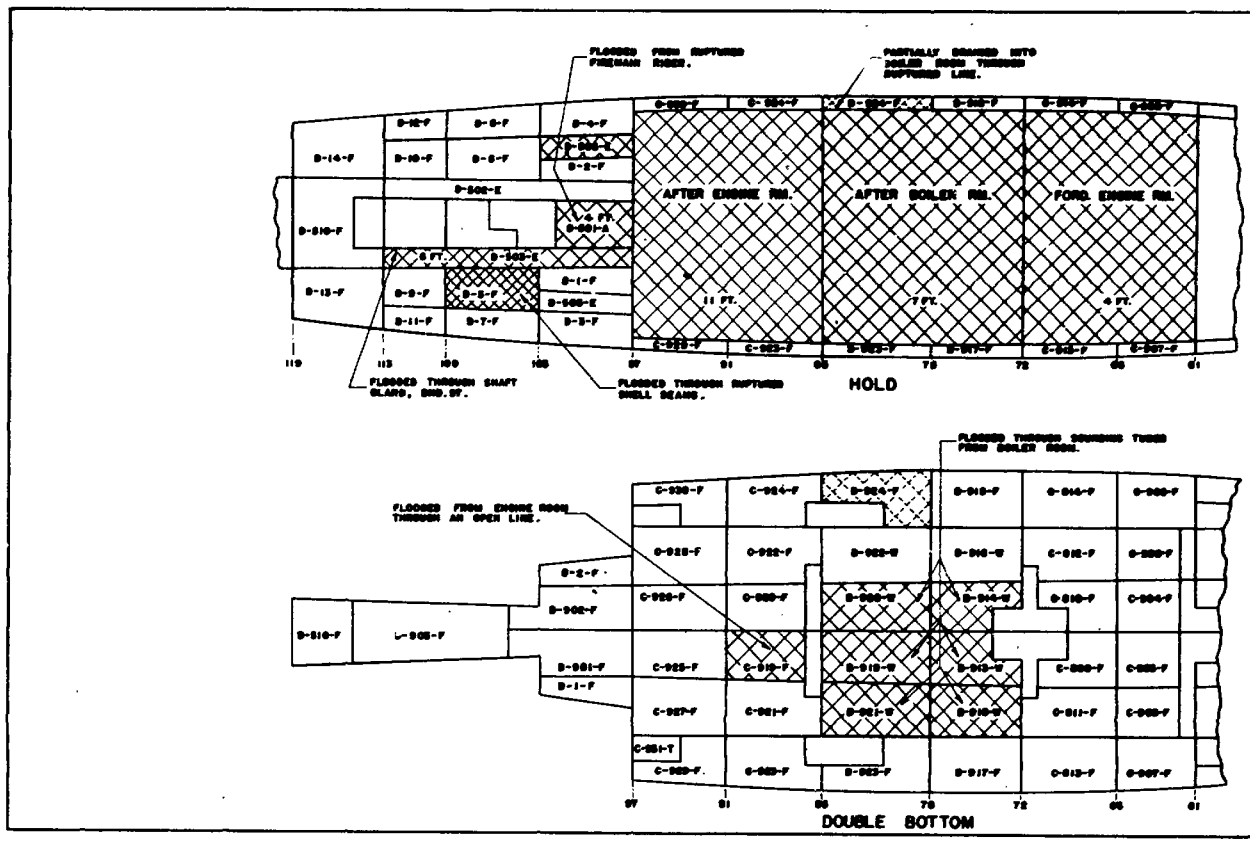


AB-CR-234-4060-3. No. 4 boiler casing.

APPENDIX

SHIP FLOODING DIAGRAM

TEST BAKER



LEGEND

FAST FLOODING

SLOW FLOODING

DRAINING

SECRET

NAVY DEPT. BUREAU OF SHIPS

FLOODING DIAGRAM

TEST B

U.S.S. SALT LAKE CITY CA 25

APPENDIX

SHIP MEASUREMENT DIAGRAM

TEST BAKER

APPENDIX

SHIP MEASUREMENT DATA

A. Deck Survey.

No deck survey was conducted after test B, on this vessel due to radiological conditions.

B. Scratch Gages.

Gages installed through the ship's length between the main and second deck indicated little or no relative movement. (Pages 96 and 97.)

DECK DEFLECTION GAGES

SHIP USS SALT LAKE CITY (CA-25) TEST B

LOCATION			MAXIMUM COMP.	MAXIMUM EXP.	PERMANENT SET		REMARKS
FR. NO.	DECK	DIST. OFF ℄			DISTANCE	EXP./COMP.	
17	2nd	Centerline	None	None	None	None	None
56	"	Port 16'	"	"	"	"	"
55	"	Stbd. 16'	"	"	"	"	"
62 1/2	"	Centerline	"	"	"	"	These gauges were cut off after test able
66	"	Port 16'	"	"	"	"	None
66	"	Stbd. 16'	"	"	"	"	"
69	"	Centerli..e	"	"	"	"	"
97	"	Port 18'	"	"	"	"	"
97	"	Centerline	"	"	"	"	"
97	"	Stbd. 18'	"	"	"	"	"

8682

DECK DEFLECTION GAGES

SHIP USS SALT LAKE CITY (CA-25) TEST B

LOCATION			MAXIMUM	MAXIMUM	PERMANENT SET		REMARKS
FR. NO.	DECK	DIST. OFF ℄	COMP.	EXP.	DISTANCE	EXP./COMP.	
124 1/2	2nd	Stbd. 18'	None	None	None	None	None
124 1/2	"	Centerline	0-0-1/8	"	"	"	"
124 1/2	"	Port 7'11"	0-0-3/16	"	"	"	"
124 1/2	"	Stbd 8'2"	0-0-1/8	"	"	"	"

APPENDIX

COMMANDING OFFICERS REPORT

TEST BAKER

COMMANDING OFFICERS REPORT
PART A - GENERAL SUMMARY

I. Target Condition after test.

(a) Drafts after test; general areas of flooding, sources.

Drafts before test: forward 19' 3", aft 20' 6"; draft after the test: forward 19' 7", aft 21' 6". The list was not accurately measured before pumping was begun but is estimated to be 3 to 4 degrees to starboard. The majority of the flooding was in the machinery spaces. The following depths of flooding were measured upon reboarding on 1 August: after engineroom 8' 1", after fireroom 5' 11 1/2", forward engineroom 2' 6". The source of the flooding of the after engineroom was through a rupture of a salt water pipe from the auxiliary condenser which had the sea valve open for the test. Other machinery spaces were then flooded through leaks in the shaft glands. See part C, section I, paragraph I(e) for further details.

(b) Structural damage; superstructure, hull, interior of hull above and below armored deck (if fitted).

Structural damage throughout the ship was very slight. The only additional damage noted above the main deck was the crushing of the bulkheads of access trunk from main deck to superstructure deck at frame 47 and the failure of one airport adjacent to this trunk. It should be noted that this damage was in a location where blast was "trapped" or "funneled" by the surrounding structure.

The principal damage below decks was from shock which damaged vent ducts and their support brackets and ruptured three branches off the fire main. These ruptures however showed evidence of being weakened by previous corrosion action.

(c) Operability: machinery, electrical, ship control, fire control, gunnery, electronics.

There was no additional visible damage to machinery or electrical equipment; except that caused by flooding which would not have occurred if the ship had been manned.

There was no additional damage to ship control equipment.

All guns in all batteries were operative. The anti-aircraft director and also the main battery director were inoperable due to the flooding of the controlling switchboard which is located in the aft gyro room.

Electronics equipment was seriously affected by shock damage.

(d) Heat: fires; estimated personnel casualties.

There was no evidence of any heat or fires.

The personnel casualties resulting from the blast (not considering radioactivity) with a war-time complement on board would have been about 5% or about 50 men. Most of these would probably have been minor cuts, bruises and burns resulting from being thrown against structure or hot machinery. There would probably have been no more than two or three deaths from severe injuries, and possibly none at all.

Casualties resulting from radioactivity would have been severe although not immediately effective. No estimate of the extent of such casualties can be given by this command.

II. Forces evidenced and effects noted.

(a) Heat.

There was no evidence of heat.

(b) Fires and explosions.

There were no fires or explosions.

(c) Shock: apparent direction; areas affected, critical scantlings, nature of joint failures (general) ; effect on machinery and equipment significant behavior of structure or equipment.

The effects of shock was apparent throughout the ship although its effect on machinery and electrical equipment was slight. The greatest effect was in the boilers, machinery spaces floor plates, gun directors and electronic equipment.

(d) Pressure: apparent direction; areas affected, critical scantlings, general nature of failures; significant behavior of structure and equipment

Very little if any damage can be attributed to pressure. One probable effect of pressure was the damage to one access trunk as described in paragraph I(b) above.

(e) Any effects apparently peculiar to the Atom Bomb.

None except that intense radioactivity remaining on the outer structure of the ship, decks, superstructure, etc.

III. Results of Test on Target.

(a) Effect on propulsion and ship control.

There was no additional damage to machinery or ship control equipment. There was some damage to boilers from shock but the ship could probably have steamed at 15 knots (assuming that the ship had not been damaged as in previous test).

(b) Effect on gunnery and fire control.

Very little blast or shock effect was found present on gunnery and fire control equipment although director control for the after 20mm battery and the 5"/25 battery was destroyed by flooding of controling switchboard. Forward AA director was inoperable due to blast effect which forced the director slightly off the roller path.

(c) Effect on water-tight integrity and stability.

Although there was no opportunity for a thorough inspection there was no additional damage to water tight integrity and stability, assuming that the flooding of machinery spaces would not have occurred, if the ship had been manned.

(d) Effect on personnel and habitability.

The blast itself would have had very little effect on personnel and habitability. The effect of radiation would undoubtedly have great effect but the extent is not known.

(e) Total effect on fighting efficiency.

The immediate effect on fighting efficiency would have been slight, perhaps not more than a 10% reduction. This reduction in efficiency would result from the damage to director systems and probably limitation of speed to about 15 knots for about 24 hours due to probable damage to boilers. The effect of radioactivity on personnel in this situation and its progressive effect on fighting efficiency is not known.

IV. General Summary.

The damage from the blast was much less than was expected. However, the intense radioactivity remaining after several days more than compensates for the lack of expected damage to structure. Special radioactivity report has been made.

PART C - INSPECTION REPORT

SECTION I - HULL

A. General description of Hull Damage.

(a) Overall condition of vessel.

The overall damage to the ship was minor. There is some evidence of distortion of the main and second decks in the after part of the ship. There appears to be some additional sagging of the decks as indicated by additional buckling of stanchions. Three firemain risers ruptured in places which showed definite evidence of being weakened by previous corrosive action. One access trunk from the main deck to the superstructure deck at frame 47 was caved in by the blast.

(b) General areas of hull damage.

Areas of damage are given in paragraph (a) above. The opening of one oil tank to the sea is suspected. See section II, paragraph A.

(c) Apparent causes of hull damage in each area.

The access trunk was apparently damaged by the blast effect which was trapped by surrounding structure.

The possible distortion of the decks is probably a combination of pressure and underwater shock

(d) Principal areas of flooding with sources.

Principal areas of flooding were in the machinery spaces. See section II, paragraph A.

(e) Residual strength, buoyancy and effect of general condition of hull on operability.

(e) Constructive criticism of superstructure design or construction including important fittings and equipment.

The only visible damage was in an area where the blast effect was trapped by surrounding structure. Although this effect was less pronounced than in test A, it demonstrates the necessity of smooth rounded surfaces on all superstructure. The many nooks and corners in the superstructure of ships makes the removal of fission products impractical and indicates that a radical change in ship design will be necessary to combat this hazard.

C. Turrets, Guns and Directors.

(a) Protected Mounts.

1. General condition, including operability.

Condition of turrets was very good. All were fully operative with power. The forward turrets showed some possible strain of blast or shock about the base ring and training rack. This could have been caused by turrets not being given required routine daily test.

2. Effectiveness of installed turrets or shields.

They are considered very effective.

(b) Unprotected Mounts.

1. General condition, including operability, if known.

5''/25 - No damage was noted in the condition of this battery. All guns were normal and fully operable.

40mm - Condition is normal except for loss of power in overtrain. Director control was also normal.

20mm - All guns were found to be normal in operation. One sight bracket in the after group was broken off due to decomposition of the metal itself.

The effect of the blast on the strength of the hull is believed to be negligible. There was apparently some distortion which could have caused weakening of some structure which would not be apparent until it failed under stress. It is believed that the general condition of the hull as a result of damage from this blast would not affect the operability of the ship.

B. Superstructure (exclusive of gun-mounts).

(a) Description of damage, giving important dimensions.

1. Bridge area.

2. Midship deckhouse and stacks.

3. After deckhouse and tower.

No damage.

(b) Cause of damage in each area.

No damage.

(c) Evidence of fire in superstructure.

None.

(d) Estimate of relative effectiveness against heat and blast of.

1. Various plating thicknesses.

2. Various shaped surfaces.

3. STS compared to MS.

4. Aluminum structure (where fitted).

Lack of damage in Test Baker provides no basis for evaluating relative damage to the various structures.

2. Effectiveness of installed sufficiency of crew shelters.

No comment.

(c) Directors and Range Finders.

1. General condition, including operability.

Forward AA Director.

Sky Forward - The Director was found to be frozen in train. Examination proved that it had apparently shifted to the starboard and aft off the roller path. One accessible holding down clip was found to be sheared off. Water had penetrated the optical cap causing slight corrosion on the sight gearing.

Mk. X Rangekeeper - The following knobs and cranks were found to be frozen due to corrosive action of salt water: Time clock knob, train searchlight knob, sight deflection knob, sight angle knob, generated range crank and course knob.

Mk. II Stable Element - The gimbal train fork had shifted due to shock (it is noted that the same condition existed after Test Able and was repaired); the cross-level gear bracket was broken and jammed against the training rack weather seal; the level and cross-level preamplifier units had their back panel broken loose by shock effect.

After AA Director

Sky Aft - Very little change was noted here; operation of the director in manual appeared to be normal. The level gearing to the telescope was found inoperable. Considerable corrosion on the Rangekeeper knobs was evident and caused some binding. The stable element was operated in manual and found to be normal.

Main Battery Directors.

Director I - No change was found in this unit upon visual inspection.

Director II - Changes in the condition of this director since the first test were: the radar frame indicator bracket was broken due to shock and the elevation gearing does not mesh.

Rangefinders - A visual inspection of these instruments was conducted. No apparent added damage was found but operability of them at this time is unknown.

2. Condition of instruments therein.

Examination showed corrosion and rust appearing on the majority of instruments.

(d) Construction criticism of design or construction of mounts, directors, foundations and shelters.

No criticism can be based on the results of test B except for protection against radioactivity.

D. Torpedo Mounts, Depth Charge Gear.

Not applicable.

E. Weather Decks.

(a) General condition of deck and causes of damage.

The general condition is very good. Evidence of slight damage aft is noted in paragraph A above in this section.

(b) Usability of deck in damaged condition.

Usability of the deck was not affected by this test.

(c) Condition of equipment and fittings.

1. Mooring and towing fittings.

2. Boats and boat handling; liferafts.

3. Airplane handling gear; airplane crane.

No additional damage to these fittings.

F. Exterior Hull (above waterline).

(a) Condition of exterior hull plating and causes of damage.

(b) Condition of exterior hull fittings and causes of damage.

(c) Details of any impairment of sheer strakes.

(d) Condition of side armor belt, if fitted externally.

No apparent damage in above areas.

G. Interior Compartments (above armor deck).

(a) Damage to structure and causes.

There was evidence of sagging of main and second decks in after section of the ship. (See paragraph A above).

(b) Damage to joiner bulkheads and causes.

No damage was evident from brief inspections. Any damage existing is undoubtedly very minor.

(c) Details of damage to access closures and fittings.

No additional damage except in the access trunk at frame 47. (See paragraph A(c)).

(d) Condition of equipment in compartment.

Although inspections were brief it is believed that all equipment was undamaged.

(e) Evidence of fire.

No evidence.

(f) Damage in way of piping, cables, ventilation ducts, etc.

There is no visible added damage to piping, or cables as a result of Test Baker. Several sections of ventilation ducts were damaged by failure of joints and brackets caused by shock. All of this type damage could be easily repaired.

(g) Estimate of reduction on watertight subdivision, habitability and utility of compartments.

The effect of this test in these respects was negligible.

H. Armor Deck(s) (if fitted)

(a) Damage to armor deck and causes of damage.

No apparent damage except the possible sagging aft as noted in paragraph A above.

(b) Protection afforded spaces below.

The protection is considered very adequate.

(c) Condition around openings.

1. Hatches.

2. Gratings.

3. Uptake bulkheads.

4. Barbettes.

No additional damage.

(d) Condition of connections to vertical armor.

Not observed.

I. Interior Compartments (below waterline)

(a) Damage to structure and causes.

No detailed inspection of these compartments could be made. However, from the general condition of the machinery spaces there is probably no more than minor damage to any structure in this area.

(b) Damage to joiner bulkheads and causes.

No damage was observed in brief inspections.

(c) Details of damage to access closures and causes.

No damage was observed in brief inspections.

(d) Condition of equipment within compartment.

See section II, paragraph A.

(e) Flooding.

See section II, paragraph A.

(f) Damage in way of piping, cables, ventilation ducts, shafts, etc.

Piping and ventilation ducts were not further damaged. Cables submerged in the after engineroom, after fireroom and after gyro room developed grounds but were undamaged otherwise.

(g) Estimate of reduction in watertight subdivision, habitability and utility of spaces.

The engineering spaces all retain their watertight subdivision and will require only moderate repair to completely re-establish their habitability and utility after the flooding.

There was no apparent effect in other compartments below the waterline.

J. Underwater Hull.

(a) Interior inspection of underwater hull.

No apparent damage.

(b) Effect of damage on buoyancy, operability, maneuverability.

No additional damage.

(c) Any known or suspected damage to:

1. Shafts and propellers.

2. Struts.

3. Rudders.

4. External keels.

No damage known or suspected.

(d) Details of impairment of keel structure.

No damage known or suspected.

K. Tanks.

(a) Condition of tanks in areas of damage.

D-5-F is apparently ruptured and open to the sea as it is now full, whereas, it was ballasted only to the waterline before the test. No other tanks are definitely known to be damaged. (see below).

(b) Contamination of liquids.

1. Extent and cause, if known.

B-913-914-915-919-920-921-W are now full although they were filled only to 95% before the test. It is possible that they are ruptured but more probably they were filled through the sounding tank when the after fireroom was flooded.

2. Effect on ship operability.

Contamination of these tanks will reduce the feed-water reserve by 50%, however, if any are contaminated, they can be cleaned and used again which will not greatly impair the ships operability.

(c) Damage (known or suspected) to torpedo defense system.

None known or suspected.

L. Flooding.

(a) Description of major flooding areas.

See section II, paragraph A.

(b) Sources of flooding.

1. Opened boundaries.

There is probably an opening in the hull in fuel tank D-5-F since this compartment was found completely full on sounding after reboarding.

2. Damaged or poorly designed system of fittings; as, access closures, piping, wiring, ventilation ducts, etc.

Ventilation ducts are very susceptible to shock damage. Whether or not weight limitations would prevent strengthening or spring mountings is not known.

(c) List of compartments believed to have flooded slowly so as to be susceptible to damage control.

All flooding was definitely slow and could have been controlled easily if the ship had been manned.

M. Ventilation (exclusive of blowers)

(a) Damage to ventilation system and causes.

1. Ducts.

Several sections of ventilation ducts failed at joints and hanging brackets. This damage is attributed to shock.

2. Closures.

These were not carefully inspected but from the condition of topside closures and the general appearance below decks, there was probably no damage.

3. Effect on habitability.

The effect on habitability was negligible. All this type damage could have been easily repaired by ship's force.

(b) Evidence that ventilation system conducted heat, blast, fire or smoke below decks.

No evidence.

(c) Evidence that ventilation system allowed progressive flooding.

No evidence.

(d) Constructive criticism of design and construction of system.

In order to withstand shock the system should either be strengthened or mounted in some design of shock mounting if weight limitations would allow.

N. Ship Control.

(a) Damage to ship control stations and causes.

1. Bridge area.

No additional damage.

2. C. I. C.

Electronic equipment damaged by shock.

3. Gyro-compass equipment.

There is evidence that both gyros sustained considerable shock, however, the loss of mercury is appreciably less this test than in Test Able. No structural damage is visible and none is suspected. The after gyro room was partially flooded which submerged wiring in the bilges to the switchboards and also the gyro motor generator set.

4. Steering gear.

No damage is apparent or suspected.

5. Interior communications.

The 17MC amplifier was partially submerged in the after gyro room which caused grounding out of this unit. The 1MC relay control was broken (except damage unknown) but is operative with amplifier continuously energized. No other damage is apparent or suspected.

(b) Constructive criticism of ship control system.

1. Layout and arrangement.

The damage sustained in the after gyro room to cables could have been averted by placing the cables in the overhead rather than in the bilges.

2. Location with respect to protection.

No criticism.

O. Fire Control.

(a) Damage to fire control stations and causes.

1. Directors and elevated control positions.

See section I, paragraph C(c).

2. Plot rooms and protected spaces.

The AA switchboard which controls the AA directors as well as the after 20mm battery was flooded out due to the rupturing of a fire main which had been previously weakened by corrosive action. This leak would have been quickly discovered and stopped if the ship had been fully manned.

(b) List of stations having insufficient protection and estimated effect on fighting efficiency of the loss of each.

The insufficient protection provided on all topside stations was defintely demonstrated in test A. In this test, however, the effects of blast and pressure were not apparent and the protection afforded was sufficient except for the radiological hazard in all topside stations.

(c) Constructive criticism of location and arrangement of stations.

Insofar as the direct effects of the blast are concerned, the location and arrangement of stations might be considered satisfactory. In order to provide protection from the intense radioactivity a radical change in ship design will be necessary.

P. Ammunition Behavior.

(a) Ready service ammunition, location, protection, behavior under heat and blast.

1. Main battery.

Excellent.

2. Secondary battery.

Excellent except for slight damage to ready service boxes.

3. 40mm, 20mm and other.

Excellent.

(b) Magazines, location, protection, forces involved, behavior.

Main battery power and projectiles; secondary battery; 40mm, 20mm and other bomb.

Excellent.

(c) List of stowages which are insufficiently protected and effects on ship survival of explosion of each stowage.

The ready service boxes which were located topside were slightly damaged due to their light construction. However, the ammunition in these boxes was not damaged. Any explosion in these stowages would cause local topside damage but would not threaten the survival of the ship.

(d) Behavior of gasoline stowage facilities.

No comment.

Q. Ammunition Handling.

(a) Condition and operability of ammunition handling devices.

1. Main battery hoists.

2. Secondary battery hoists.

3. Passing scuttles.

4. Bomb and torpedo elevators (none installed).

No damage.

(b) Evidence that any ammunition handling devices contributed to passing of heat, fire, blast or flooding water.

No criticism.

(c) Constructive criticism, of design and construction, of ammunition handling devices.

No criticism.

R. Strength.

(a) Permanent hog or sag.

1. Hull evidence.

There was some evidence that the main and second decks in the after section of the ship had some additional sag which was indicated by additional buckling of stanchions. This conclusion is from visual examination only and is not considered conclusive.

2. Superstructure expansion joints, etc.

None installed.

3. Local evidence of longitudinal stresses.

None.

(b) Shear strains in hull plating.

None apparent.

(c) Evidence of transverse or racking strains.

None apparent.

(d) Details of any local failures in way of structural discontinuities.

None observed.

(e) Evidence of panel deflection under blast.

See paragraph A above.

(f) Turret, machinery and gun foundations.

No damage observed.

S. Miscellaneous.

(a) Evidence of heat damage variations under various colors of camouflage painting.

There was no evidence of heat damage in any area.

SECTION II - MACHINERY

A. General Description of Machinery Damage.

(a) Overall condition.

Upon reboarding, the after engineroom, after fireroom, forward engineroom, and #4 shaft alley were found to be partially flooded.

All machinery submerged in the after engineroom has been flooded with salt water and has not been cleaned or repaired, this includes: #2 and #3 main engines complete with cruising turbines and reduction gears, auxiliary lube oil pumps, jacking motors, main lube oil pumps, main air pumps, #3 and #4 main feed pump, #2 flushing pump including steam and electric drive, #2 lube oil purifier, balance coil for #3 and #4 ship's service generators and main feeders from these generators to the after distribution board. The depth of water at the centerline was 8' 1".

The after fire room was flooded to a depth of 5- 11 1/2" at the centerline which brought water up to about the middle of the mud drums. Fuel oil service pumps and booster pumps, evaporator auxiliaries and second effect shells, fuel oil manifolds on boilers #5, #6, #7, and #8, and the furnaces of these boilers and lighting wiring on the lower level were submerged.

The flooding in the forward engineroom was so minor that no machinery was submerged or damaged. No flooding occurred in the forward fireroom.

#4 shaft alley was flooded through the shaft bulkhead to a depth of about 6'. The spring bearings were submerged and require cleaning, however, they have had no structural damage.

The cables running in the bilges of the after gyro room were submerged and are grounded, no effort has been made to clear them.

In general no machinery has suffered any structural damage and no foundations have been broken. Boiler casings previously ruptured seem to have buckled a little more and the casings of #5 and #6 previously repaired have again been ruptured. Minor damage to brick and plastic in all boilers has been experienced.

(b) Areas of major damage.

See above.

(c) Primary Causes of Damage in each area of Major Damage.

Flooding was caused by rupturing of a nipple to the relief valves on the dynamo cooling service line which is supplied by #2 auxiliary condenser injection. This injection was left open as part of the test. Progressive flooding through #1 and #4 bulkhead shaft glands caused flooding of the after fireroom to a depth of 5' 11" and 2' 6" in the forward engineroom. The after gyro room was flooded to a depth of about three feet as a result of rupturing a firemain riser in that space. Water in the firemain drained into the after gyro room.

(d) Effect of Target Test on Overall Operation of Machinery Plant.

If radiological considerations could be ignored such that the crew could have returned shortly after the test, there would have been only minor effect on operation of the machinery, as the leaks could have been stopped before any damage was done. Thus, except for the flooding, it only would have been necessary to repair the boilers by patching brickwork, plastic and casings and to make routine inspections and tests to the remainder of the machinery.

NOTE: On each of the following groups of machinery B to W, significant damage should be described and analyzed for extent, effect upon operation of the machinery plant, AND FOR CAUSE. Where damage warrants a further more detailed technical inspection, emphasize this fact.

B. Boilers (S-51).

(a) Air Casings.

All casings previously ruptured have been additionally buckled. The casings to boilers #5 and #6 were repaired prior to the test and were again ruptured but only slightly by Test Baker. All damage is attributed to shock.

(b) External fittings (stop and check valves, safety valves, etc).

No damage.

(c) Fuel oil burner assemblies.

No damage.

(d) Brickwork and furnaces

There was additional damage to brickwork and plastic but to a much less degree than Test Able. Minor patching of brick and plastic in boilers #5 and #6 has enabled them to be ready for steaming.

(e) Steam and water drums and headers.

No visible damage.

(f) Tubes (generating, superheater, downcomer, economizer).

No visible damage.

C. Blowers.

(a) through (f), no damage.

D. Fuel Oil Equipment (S-55).

(a) through (d), no damage.

E. Boiler Feedwater Equipment.

(a) through (d), no damage.

F. Main Turbines (S-41).

(a) through (h), no known damage.

G. Reduction Gears (S-42).

(a) through (f), no damage.

H. Shafting and Bearings (S-43).

(a) through (d), no damage.

I. Lubrication System (S-45).

(a) through (e), no damage.

J. Condensers and air ejectors (S-46).

(a) through (e), no damage.

(f) Miscellaneous valves, gages, fittings, and attached piping.

See section II, Paragraph A above.

K. Pumps (S-47).

Report most pumps under this heading, discussing for each the foundations, operability, condition of motor or turbines, fittings, etc.

(a) Feed Pumps.

#3 and #4 were submerged, otherwise there was no damage.

(b) through (g), no damage.

L. Auxiliary Generators (Turbine and Gears) (S-61).

(a) through (f), no damage.

M. Propellers (S-44).

(a) through (b), no suspected damage.

N. Distilling Plant (S-58).

(a) through (d), no suspected damage.

O. Refrigerating Plant (S-59).

(a) through (g), no apparent damage.

P. Winches, Windlasses, and Capstans (S20-26).

(a) through (g), no damage.

Q. Steering Engine (S-22)

(a) through (f), no visible damage.

R. Ammunition Hoists, etc. (S-78-83).

(a) Machinery Foundations.

(a) through (d), no apparent added damage.

(e) Elevator Platforms.

None installed.

(f) through (h), no apparent added damage.

S. Ventilation (Machinery) (S-38).

(a) through (d), no damage.

T. Air Compressors (S-49).

(a) through (e), no visible damage.

U. Diesels (generators and fire pump) (S-50)

(a) through (f), no damage.

(g) Miscellaneous.

Boat diesel engine, no visible damage.

V. Piping.

Piping will require a somewhat different inspection approach than the machinery groups above. Conditions should be noted while moving from compartment to compartment, notes being made on a piping system basis according to the following list. Particular attention should be paid to weak design points, adequacy of parallel systems to take over functions, and probable effect of damage on personnel as well as on operation.

(a) through (f), no visible damage.

(g) Firemain, sprinkling, and water curtain.

Shock ruptured the firemain in the following spaces where the piping was badly corroded: recreation compartment, marine washroom and the after gyro room.

(h) Condenser circulating water.

#1 main injection has a few pinhole leaks and a four inch crack. #2 auxiliary condenser lead to dynamo service line has a broken nipple to relief valve.

(i) through (k).

No damage.

(l) Gasoline.

System is not in commission; damage is unassignable.

SECTION III - ELECTRICAL

A. General Description of Electrical Damage.

(a) Overall condition.

Except for wiring and motors which were water soaked in the after engineroom, the after fireroom and the after gyro room, there is little damage.

(b) Areas of major damage.

See above.

(c) Primary causes of damage in each area of major damage.

See above.

(d) Operability of electric plant.

1. Ship's service generator plant.

The balance coils of #3 and #4 were submerged as were the feeders to the after board. #1 and #2 generators are undamaged.

2. Engine and boiler auxiliaries.

The following were flooded and grounded: Lube oil purifier motor, #2 auxiliary condenser pump motor and #2 and #3 jacking motors.

3. Electrical propulsion.

None installed.

4. Communications.

1MC has a broken starting relay otherwise it is undamaged. 17MC amplifier was flooded in the after gyro room. All other IC circuits are apparently undamaged.

5. Fire Control Circuits.

All FC circuits in the after gyro room were flooded making the 5" battery and the after 20MM battery inoperative for director control. Otherwise there was no added damage to FC circuits.

6. Ventiltation.

No damage.

7. Lighting.

Wiring in lower levels of after engineroom and after fireroom was submerged. Wiring in after gyro was also water soaked. There were no broken cables.

(e) Types of equipment most affected.

(1) through (4), no damage.

B. Electric Propulsion Rotating Equipment.

Not applicable.

C. Electric Propulsion Control Equipment.

Not applicable.

D. Generators - Ship's Service (S-61).

The balance coil and feeders from #3 and #4 generators were submerged, otherwise no damage.

E. Generators - Emergency (S-61).

(a) through (f), no damage.

F. Switchboards, Distribution and Transfer Panels.

(Ship's service, emergency, battery charging, lighting and test switchboards – power and lighting distribution panels - submarine torpedo heating and hydrogen burning panels - transfer panels - degaussing panels). (S-62).

(a) through (k), no damage.

G. Wiring, wiring equipment, and wireways (S-62).

(a) Cable (power, lighting, I.C., F.C., propulsion and degaussing).

See above regarding localities where submerged.

(b) Wireway supports.

No damage.

(c) Connection, junction boxes, receptacles, and plugs.

See section III, Paragraph A(a) and Paragraph A(a) 7.

H. Transformers (Lighting and I.C.) (S-62).

(a) through (b), no damage.

I. Submarine Propelling Batteries.

Not applicable.

J. Portable Batteries (S-62).

(a) through (d), no damage.

K. Motors, motor generator sets, and motor controllers (motor and controllers for engineroom auxiliaries, steering gear, deck auxiliaries, air conditioning and refrigeration, ventilation, distilling equipment, etc., motor generator sets for lighting, welding, degaussing, battery charging, interior communications, etc.) (S-63).

(a) and (b). There was no damage to any motors except the following which were submerged and they did not experience structural failures: #2 and #3 jacking motors. #2 lube oil purifier motor, #2 sanitary pump motor, and #2 auxiliary condenser circulating pump motor.

L. Lighting Equipment (S-64).

(a) through (f), no damage.

M. Searchlights (36", 24", 12" and 8") (S-66).

(a) Framework and mountings.

(a) through (g), no added damage.

N. Degaussing Equipment (S-81).

(a) Compass Compensating coils and control boxes.

(a) through (c), no damage.

O. Gyro Compass Equipment.

(a) Master.

There was slight splashing of mercury but no evidence of structural damage. #1 gyro was successfully started. #2 gyro room was flooded and all cables were grounded out.

(b) and (c), no added damage.

P. Sound Powered Telephones.

(a) through (d), no damage.

Q. Ship's Service Telephones.

(a) and (b), no damage.

R. Announcing Systems.

(a) Portable (PAM and PAB).

None installed.

(b) through (f), no damage.

S. Telegraphs.

No damage.

T. Indicating System.

No damage.

U. I.S. and A.C.O. Switchboards.

V. F.C. Switchboards.

All F.C. switchboards were undamaged, however, the wiring in the bilges to the after F.C. board was submerged in water and was grounded out.

SECTION IV - ELECTRONICS

A. General Description of Electronics Damage.

(a) Overall condition.

By the standards set in ECO letter, serial 177, 25 June, the damage to electronics equipment was light. This means it could have been repaired by ship's crew, probably in one or two days.

(b) Areas of Major damage.

Most of the damage occurred in the radar transmitter room and fire control workshop.

(c) Primary cause of damage in each area.

Shock was the primary cause of damage in all areas.

(d) Operability of electronics equipment.

1. Radar.

Surface search radars would probably have been operable after the test. Air search radar, and fire control radars would have been inoperable.

2. Radio.

No apparent added damage.

3. Sonar.

No apparent added damage.

4. Loran.

No apparent added damage.

(e) Types of equipment most affected.

Fire Control radars sustained most of the total damage.

B. Fire control radar.

(a) Mark III, Serial #14, (fwd).

Both sides and back (covers) were knocked loose. Some of the securing knurled knobs somehow became completely unscrewed. One of the magnetron filament leads was torn loose, and both glass filament envelopes were broken. V1 and V2 (701A-keyers) were out of their sockets and smashed. V3 (705A-diode clipper) was also knocked from its socket, the envelope being unbroken but the internal elements damaged. No inspection was made of units in the main battery director.

(b) Mark IV, Serial #206, (fwd).

Both side and back covers were knocked loose. One of the magnetron glass filament envelopes was broken. V1 (701A - keyer) was knocked out of its socket and probably damaged internally although the envelope remained intact. V2 (701A - keyer) was knocked from its socket and smashed. V3 (705A - diode clipper) was knocked from its socket and damaged internally. VS1 and VS2 (705A's - H.V. power supply) were knocked from their sockets and had open filaments. The socket base of the second pre-amplifier was knocked off, the fins being bent. The H.V. power supply drawer pulled out with great difficulty. The main frame may be bent. The C and I unit in the director was knocked loose from its shock mount at both inboard corners.

(c) Mark III, Serial #105, (aft).

V2 (701A - keyer) was smashed in its socket. Both magnetron glass filament envelopes were broken.

(d) Mark XXIII, Serial #3, (aft).

There was no apparent physical damage to units in CIC aft. However, most of these units, especially the ones mounted highest, suffered corrosion from salt water. The transmitter sustained no apparent internal damage. The reflector dish was bent and torn from one of its braces in the upper right-hand quadrant (looking from behind it), where some object probably struck it.

C. Surface Search Radar.

There was no apparent damage to either surface search radar. There was evidence, however, of severe shock. The rubber gasket around the nomter panel in the Mod-Gen Unit was found out of place. Neither set has been fired up.

D. Air Search Radar.

The SK air search equipment was inoperable after the test. All four ring oscillator tubes (427A's) were broken at their glass to metal seals. No other damage was apparent. The set has not been fired up.

E. Radar Repeaters.

There was no evidence of damage to repeater PPI's.

F. Radar Counter Measures Equipment.

No apparent added damage.

G. Radar and Radio Beacons.

There is no equipment of this type aboard.

H. IFF Equipment.

No apparent added damage.

I. Communication Transmitters (Radio).

No apparent added damage.

J. Communication Receivers (Radio).

RBK receiver operated on 29.7 mc.; the other receivers appeared operative.

K. Communication Antennae (Radio).

All antennae were blown dow or damaged by Test Able. No change in their condition was apparent after Test Baker.

L. Radio Transceivers (Combined Transmitters and Receivers).

No added damage.

M. Sonar Echo Ranging and Listening Equipment.

There is no equipment of this type aboard.

N. Sonar Echo Sounding Equipment and Altimeters.

No apparent damage.

O. Loran Navigation Equipment.

No apparent added damage.

P. Power Supplies (Motor generators and filters).

No added damage.

Q. Television and Teletype Equipment.

There is no equipment of this type aboard.

R. Test Equipment (Including Frequency meters).

No added damage.

T. Telephone Equipment.

No added damage.

U. Direction Finders (Radio).

None on board.

V. Spare Parts.

No apparent damage.

Defense Special Weapons Agency
6801 Telegraph Road
Alexandria, Virginia 22310-3398

TRC

18 April 1997

MEMORANDUM FOR DEFENSE TECHNICAL INFORMATION CENTER
ATTENTION: OMI/Mr. William Bush (Security)

SUBJECT: Declassification of Reports

The Defense Special Weapons Agency has declassified the following reports:

AD-366588	XRD-203-Section 12
AD-366589	XRD-200-Section 9
AD-366590	XRD-204-Section 13
AD-366591	XRD-183
AD-366586	XRD-201-Section 10
AD-367487	XRD-131-Volume 2
AD-367516	XRD-143
AD-367493	XRD-142
AD-801410L	XRD-138
AD-376831L	XRD-83
AD-366759	XRD-80
AD-376830L	XRD-79
AD-376828L	XRD-76
AD-367464	XRD-106
AD-801404L	XRD-105-Volume 1
AD-367459	XRD-100

TRC 18 April 1997

Subject: Declassification of Report

AD-376836L	XRD-98
AD-376835L	XRD-97
AD-376834L	XRD-96
AD-376833L	XRD-95
AD-376832L	XRD-94 re-ingest
AD-367458	XRD-93
AD-367457	XRD-92-Volume 2
AD-367456	XRD-91-Volume 1
AD-367455	XRD-90
AD-367454	XRD-89
AD-367453	XRD-88
AD-367452	XRD-87
AD-366764	XRD-86
AD-376837L	XRD-99
AD-366758	XRD-78
AD-366734	XRD-44
AD-366763	XRD-85
AD-376829L	XRD-77
AD-367462	XRD-103
AD-367463	XRD-104
AD-367461	XRD-102
AD-367460	XRD-101

TRC 18 April 1997

Subject: Declassification of Reports

AD-801406L ✓ XRD-114.

In addition, all of the cited reports are now **approved for public release; distribution statement "A" now applies.**

Ardith Jarrett

ARDITH JARRETT
Chief, Technical Resource Center